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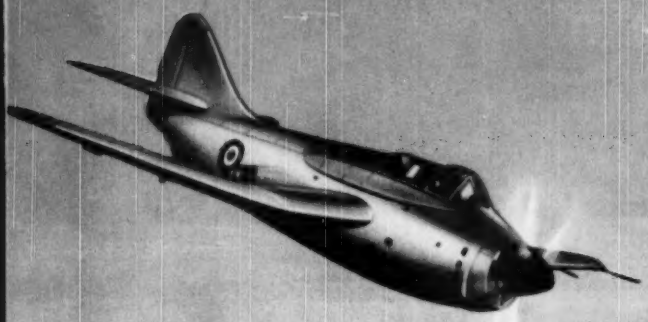

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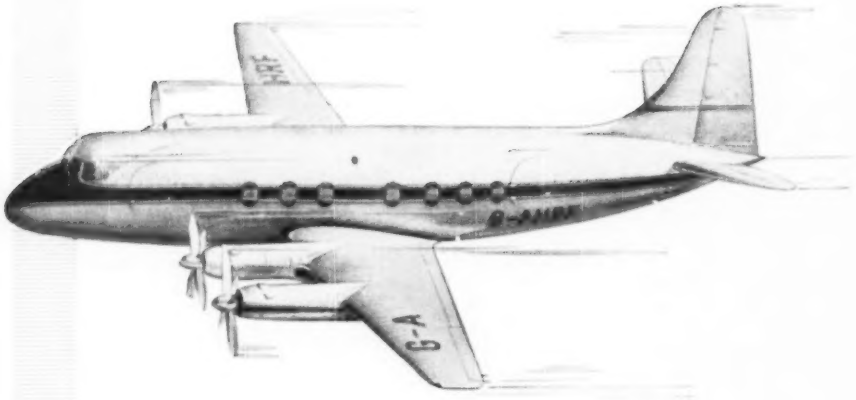

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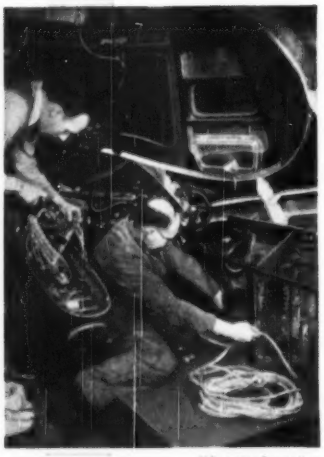

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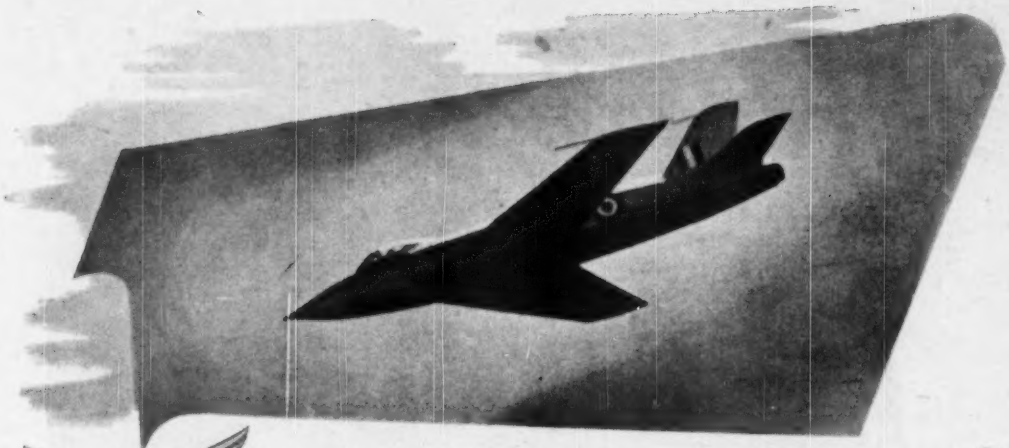
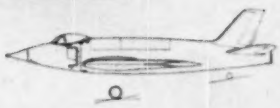


service to the aircraft industry



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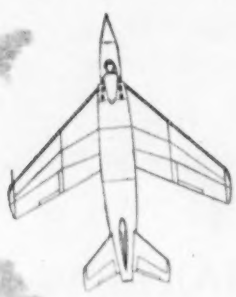

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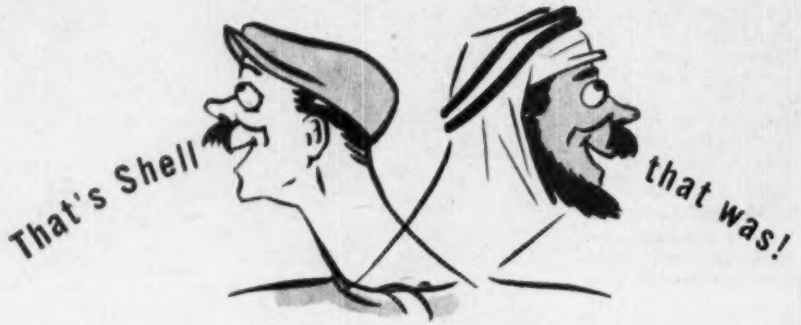

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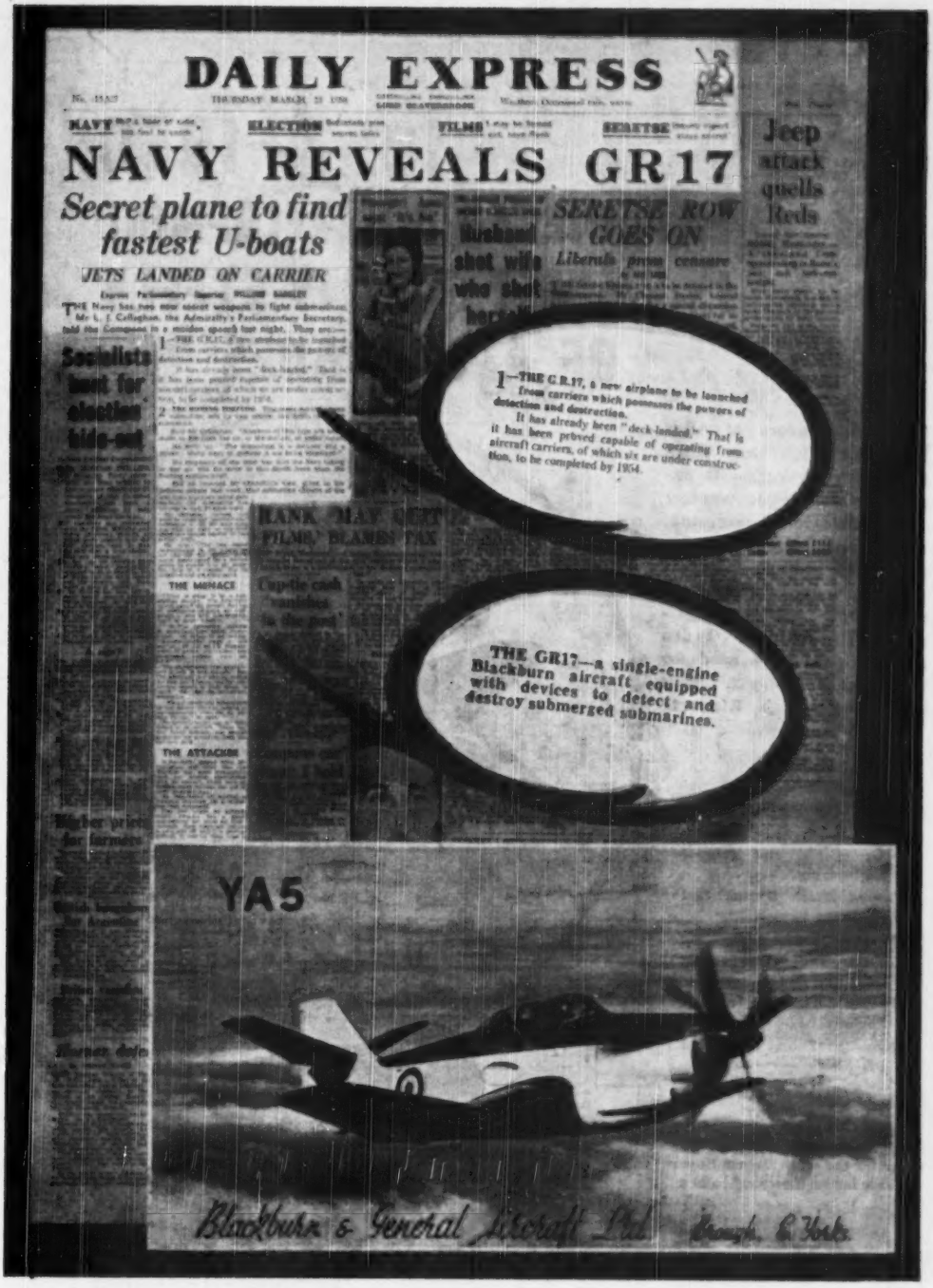
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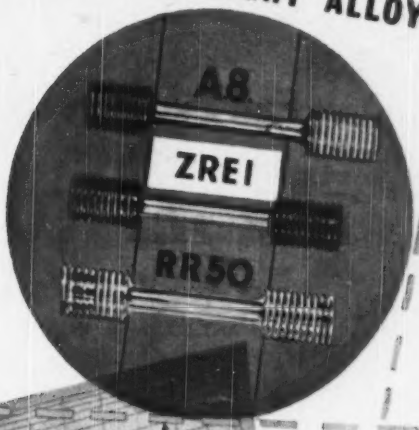

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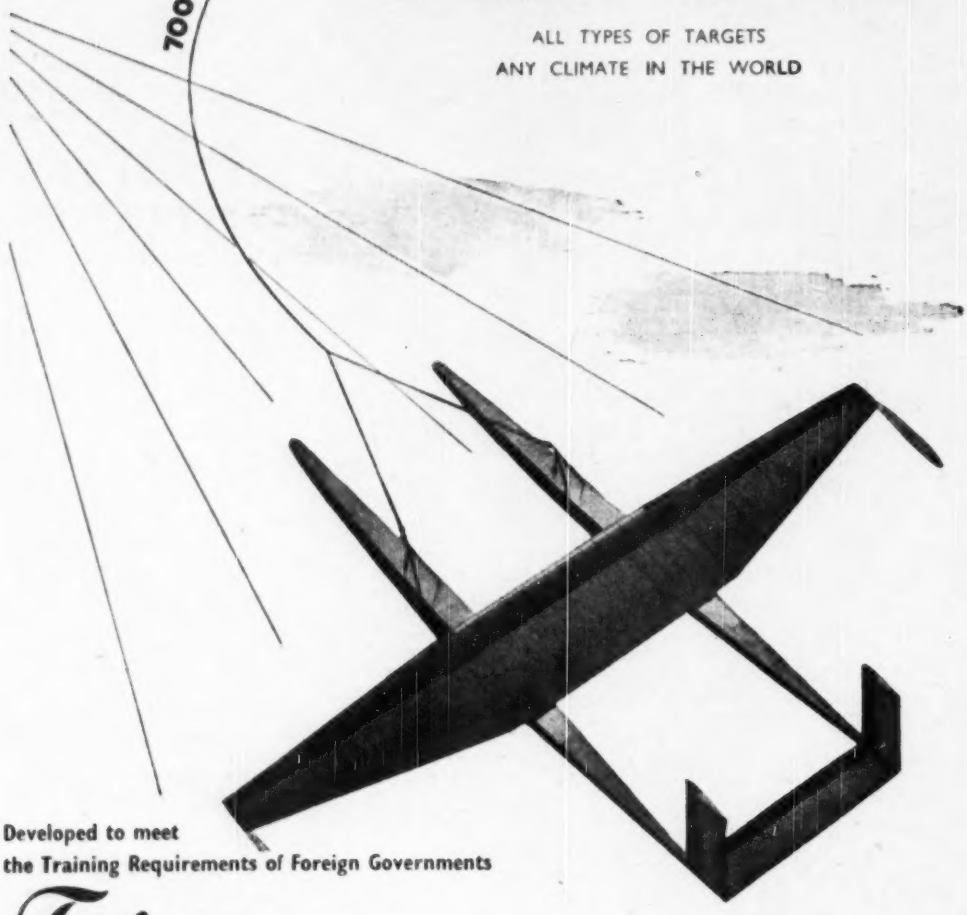

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First Aeronautical Weekly in the World

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No. 2158 Vol. LVII. THURSDAY, 4 MAY 1950

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Can We Afford This?

INSIDIOUSLY, and sometimes unavoidably, the almighty dollar has come to be the yardstick by which our trading values are measured. Doubly unfortunately, the fact has encouraged individuals to offer the plea "we cannot afford it" as an excuse for what is merely business faint-heartedness.

The need to close the dollar gap for the nation, or, in the case of the airways Corporations, the gap between revenue and expenditure, must receive high priority; but if some of the measures employed are likely to result in other kinds of gaps and deficiencies, they are strongly to be discouraged. It is our belief, for example, that neither the civil operators nor the Services are attaching sufficient importance to the flying-boat. Many pay lip-service, and the public have definitely indicated their liking for flying-boats; but because certain aspects of their operation are at present more costly than those of landplanes, a situation arises which is reflected in the decision to abandon a fleet of new Solents.

In this instance, only the cost is being considered, although we know that many people are reluctant to discard the boats. B.O.A.C.'s position we appreciate, but those who, like ourselves, see an increasingly important future for flying-boats as the volume of traffic justifies larger and larger transports, are unhappy about the lack of operational continuity and loss of experience—deficiencies which must seriously threaten future operations, especially in the case of the Princess boats of which so much is expected. The shadow is even cast upon the future of such courageous projects as the Duchess-class jet flying-boat announced in this issue.

Under existing conditions a very strong case can, admittedly, be put up for the medium-sized landplane with high-frequency operation on Atlantic and other services. It is the additional requirements of the quite near future, on many intercontinental routes, which should not be overlooked, and these may call for "Cunarders" of the air—large because of the range and accommodation required, and flying-boats because at such a weight they show several advantages. The world will be unable to offer sufficient runways of the requisite size and strength for comparable landplanes. Big transoceanic flying-boats are the logical air complement to the fleet of British luxury Sea-going liners.

The current preoccupation with landplanes is already tending to leave the flying-boats on the shelf, and it would be little short of disastrous to wait until marine aircraft are urgently required and then find that the knowledge and operating experience is irrevocably outdated.

Military Aspects

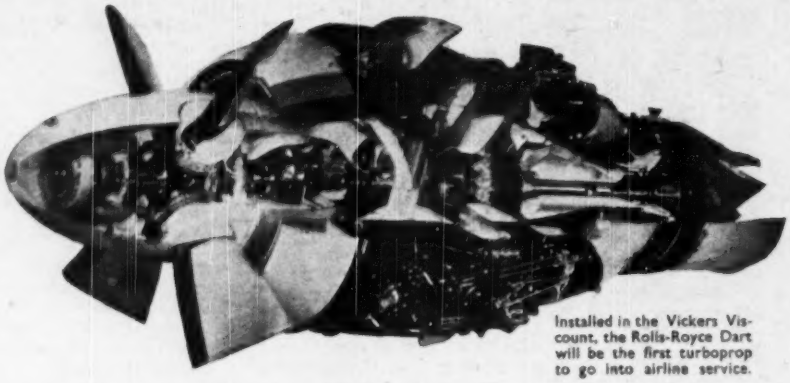
No one can predict, even from month to month, where forces will need to be deployed in wartime, but experience has shown that airports and airfields are always priority military targets. Flying-boats alone can operate from bases which are virtually indestructible. This distinction is no less important for being universally recognized; yet, as we have already had occasion to remark, flying-boat development appears to be almost at a standstill in this country, and but for a few old Sunderlands no boats are in operation. To us this seems a most serious deficiency; it prompts the suggestion that, rather than the selling of B.O.A.C.'s fleet of Solents for a fraction of their cost to anyone who will have them, reconversion into military boats of Seaford type—from which they originally sprang—should be considered.

The nation cannot afford to build, extend, or maintain abroad sufficient airfields and runways for its military needs, and, in the Far East in particular, neither can the countries concerned. Moreover, it is virtually impossible to build airfields in the far-northern territories or on mountainous islands. In emergency, therefore, flying-boats might well be the only means of reaching such places in a reasonable time.

If, as we believe, military and civil flying-boats have an important future, the solution to the immediate difficulty (which amounts chiefly to the cost of maintaining bases abroad for a few machines) may well lie in the combination of civil and military resources, to the ultimate benefit of the country as a whole.

THE LIFE of a TURBOPROP

How Reliability is Achieved: Mr. R. N. Dorey's Lecture to the S.A.E. in New York



Installed in the Vickers Viscount, the Rolls-Royce Dart will be the first turboprop to go into airline service.

THOUGH the Americans have not yet brought the turboprop type of power unit to a state of development comparable with that obtaining in this country, they are nevertheless, showing a great deal of curiosity. It was to be expected, therefore, that Mr. Dorey's paper at the S.A.E. Aeronautic Meeting in New York would arouse a good deal of interest, for it gave a comprehensive picture of the behaviour of the Rolls-Royce Dart under conditions of extended service.

As manager of the Rolls-Royce power plant and flight development section, Mr. R. N. Dorey, O.B.E., B.Sc.Eng., F.R.Ae.S., has been closely associated with the development of the Dart and its installation in the Vickers Viscount. A slightly abbreviated version of the first part of his paper follows; Part II will appear next week.

As a member of the Rolls-Royce team of engineers (said Mr. Dorey) I have responsibility for, among other projects, the development of the Dart turboprop engine. This paper is written around its past, present and future development. The views I express are entirely my own and do not necessarily represent the official view or policy of Rolls-Royce, Ltd.

The Dart—designed by Mr. L. Howarth, whose turbine experience goes back to 1942—is a two-stage centrifugal-compressor engine of 1,400 b.h.p. at sea level, weighing (complete with oil, oil tank, oil cooler, air intake, nose de-icing and starter) 993 lb. Its first serious application will be to the Vickers-Armstrong Viscount airliner. In accepting responsibility for the Viscount commitment we have, we believe, undertaken a task which has not previously been attempted in any other country, namely, to launch an engine for airline use without any previous military background.

For an aircraft of any type certain economics of the engine are necessary to enable the airframe manufacturer to prepare figures showing the costs of operation, overhaul times and anticipated life. We have committed ourselves to a warranted time of 1,500 hours for the major parts and, depending on experience prior to actual airline use, we are thinking in terms of 500-hour overhaul periods.

As we see the picture to-day the following is our anticipated trouble list in order of magnitude:—

(1) Flame tubes and nozzles.
(2) Nozzle guide-vanes.
(3) Turbine blades.
(4) Bearings and air seals.
(5) Gearing.
(6) Air and oil joints.
(7) Making two engines alike.

The Dart has over 6,000 hours of test-bed and hangar development-running behind it. The total flying time is nearly 3,000 hours, including nearly 2,000 engine hours in the Viscount itself. Design was started in early 1945 and the first engine ran in the summer of 1946. The first complete type test (model test) was run in 1948 at a rating of 1,000 b.h.p., followed in September of the same year by another test at 1,250 b.h.p.

Darts fitted to the Viscount have a full C. of A. and an overhaul life of 250 hours, this figure being decided with a view to obtaining experience. Four engines have just recently reached this figure. Others, at the 1,400 b.h.p. rating, are at present under development.

[The author then dealt with his "trouble list" item by item, as follows, illustrating his points with slides.]

(1) *Flame Tubes.*—The problem [as emphasized by slides showing flame tubes after lengthy periods of service] is one of cooling the skin. The general effect of a hot portion between the head and skirt is cracking and buckling. We have found that steady running conditions similar to those of the test bench does far less harm to the tubes than the fluctuating conditions of flight.

The essence of long life is to keep the skin temperature down, and in designing a tube to run at a lower metal temperature, several conflicting requirements have to be met. No increase in jet-pipe temperature must take place, no change to nozzle guide-vane temperature traverse—assuming this was correct beforehand—and no increase in pressure-drop. The skin-cooled tube appears to meet all these conditions but extended mechanical tests have still to be done.

Tubes are at present manufactured in Nimonic 75 material and this is still the best we know. Tests are also proceeding with ceramic coatings on the inside of the tube. I am very optimistic that the use of ceramic as a protective reflecting layer may open up the possibility later of using a less expensive material while still further improving the life. My own objective in this connection is to eliminate the flame tube entirely and coat the air casing itself with an insulating and/or reflecting material. With afterburning the gas temperature is some 900 deg F (500 deg C) in excess of that inside the engine and combustion is controlled without any flame tube. Temperature traverse and skin cooling is, of course, a problem.

Flame-tube life is also affected by the type of fuel used and by burner design and spray cone angle. Our early attempts at endurance running on the Dart produced carbon deposit on the burners, the effect of which is to deflect the spray on to the skin, with catastrophic results. The original burner and the latest development after more than three times the running time are illustrated (Fig. 1). We are now satisfied that we have eliminated the burner

problem and the changes introduced are shown in Fig. e.

If leaded fuel is used greater care is necessary in keeping flame-tube material at as low a temperature as possible to prevent lead attack. The lower cut fuels of A.N.A.58 variety also present further difficulties, due to aromatic content and carbon formation. We have encountered these problems on other engines and energetic action is under way to overcome them. We do not propose to release the Dart for any fuel other than kerosene.

(2) *Nozzle Guide-vanes and Nozzles.*—Operating temperature of the nozzle guide-vane is the limiting condition of the engine so far as power and specific consumption are concerned. The effect of flame temperatures on specific consumption is shown in the graph (Fig. 3). An increase of, say, 90 deg F (50 deg C) flame temperature is a prize well worth striving for. Our present limit is 2,034 deg F absolute (1,130 deg K) for take-off, and 1,800 deg F absolute (1,050 deg K) for maximum cruise. These figures were established both from running on the Dart engine and using our Derwent experience. Futhermore, we have established our limiting temperature by running a complete model test at 2,105 deg F absolute (1,170 deg K max.) and 2,034 deg F absolute (1,130 deg K) for cruise. The nozzle guide-vanes were scrap after this test. At 2,034 deg F (1,130 deg K max.) we have vanes which have completed 900 hours' running.

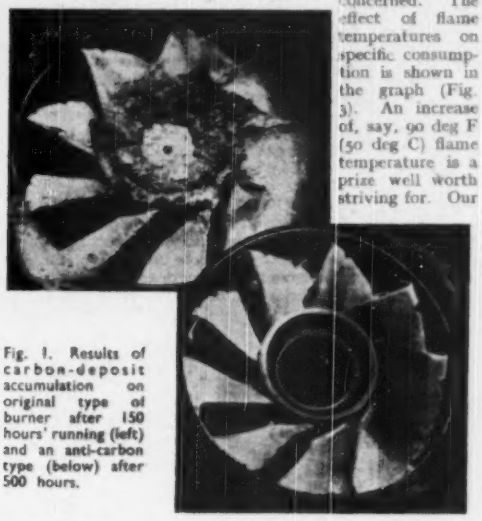


Fig. 1. Results of carbon-deposit accumulation on original type of burner after 150 hours' running (left) and an anti-carbon type (below) after 500 hours.

Further development has shown that making nozzle guide vanes hollow and keeping as nearly as possible to constant metal section reduces the incidence of cracking and bending due to temperature shock. The next desirable step is to introduce air cooling, but this involves a rather complex problem. Increase in specific consumption and decrease in power due to the use of compressor air for cooling is indicated in the graph (Fig. 4).

With the introduction of n.g.v. cooling some increase in life can be assured at a price. If an acceptable compromise can be established, and this can only be done by operating experience, it may be possible to reduce the metal temperature and still further increase flame temperature. This would thereby restore specific consumption and improve n.g.v. life at a slight cost in b.h.p.

The cooled n.g.v. is a project we are actively pursuing since its application to the turboprop re-acts in the manner described above, but on the pure jet it opens the possibility of increasing the rating as a war-time emergency or de-rating the material specification should the supply of strategic materials become difficult. The method of introducing cooling air through the hollow nozzle guide vanes is illustrated (Fig. 5).

If air cooling drops the vane temperature by 180 deg F (82 deg C), which is then restored by increasing jet-pipe temperature, the effect is shown on Fig. 3.

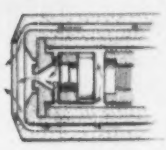
As regards materials for n.g.v., Vitallium has given the best results but supply in Britain is difficult, while Hastalloy C is showing promise and is almost equal to Vitallium. A good third is H.R. Crown Max, but this suffers from cracking due to temperature shock. I believe that concurrently with the introduction of cooling we shall be able to use a fabricated vane. This would considerably ease production as well as being cheaper initially and on overhaul.

Experience to date shows that after 800-900 hours' running about 5 per cent of the vanes have to be scrapped, mainly due to leading-edge cracking; these are all H.R. Crown vanes and not hollow.

Nozzles are now very reliable, manufactured in Nimonic 75 with external air cooling and we do not anticipate any major expense on overhaul.

(3) *Turbine Blades.*—Our present design of turbine blade has given excellent results as regards reliability, failures having been confined to accidental overheating and external damage. You will notice we use the shrouded type of blade—I mention this because while in England we have been busy putting shrouds on, I believe that in the U.S.A. you have been equally busy taking them off.

Vibration characteristics of the blade have been put outside the running range of the engine by shrouding; this in itself is a good reason for adopting them, but the main reason is one of performance.



The latest design of blade is shown in Fig. 6, where it will be noted the root has been extended. The reason is to keep the Nimonic 80A material for the hot part of the turbine and reduce the disc

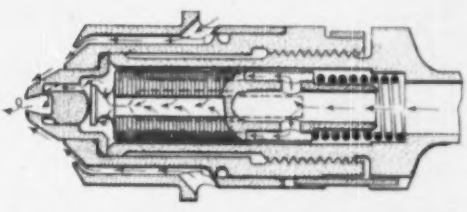


Fig. 2. Sectional elevations of original type of burner (above) and redesigned type to overcome carbon-formation problems.

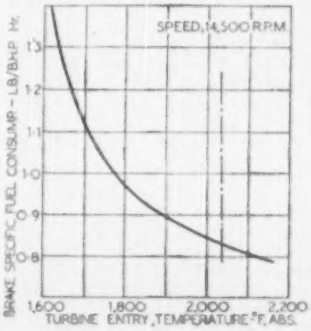
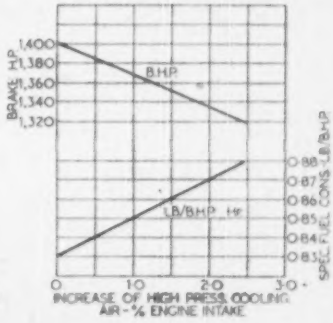


Fig. 3 (left). Effect of engine working temperature on specific fuel consumption. Fig. 4 (right). Increase in specific consumption and decrease in power, caused by use of compressor air for cooling.



THE LIFE of a TURBOPROP . . .

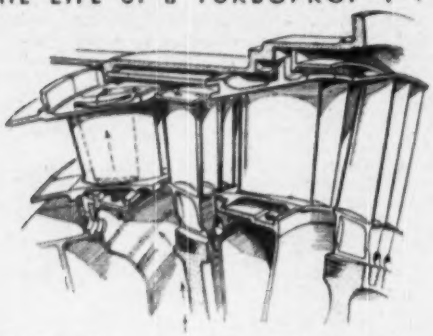


Fig. 5. Introduction of cooling air in hollow nozzle guide-vane.

diameter to the point where normal (S62) steel can be used. Experience has shown us that apart from Nimonic's expensiveness the control of consistent quality has been difficult. Metallurgically we can set a limit for S62 at 932 deg F (500 deg C) but in actual practice we shall not exceed 805-840 deg F (430-450 deg C). This is achieved on the Dart partly by reducing disc diameter and partly by air cooling. The reason for the compromise is to economize as far as possible in the use of compressor air for cooling.

Having taken this line the logical step is to use the cooling air to cool the blades. It may not be possible to bring air up inside the disc for strength and/or rigidity considerations, but air can be introduced at the blade root (Fig. 7).

If may be possible at a later date to employ fabricated turbine blades—our early researches in this direction indicate definite advantages as regards vibration characteristics but a difficult manufacturing problem from a welding point of view. Such a development is worth while if only to obtain experience on air cooling itself. The alternative may be a sodium-cooled blade if we can find a suitable material to run with it.

The application of these developments to n.g.v. blades and discs will not be achieved in our early Dart engines but they all lead in the direction of improved reliability, improved fuel economy, reduction in overhaul and initial cost together with a small reduction in weight. Our objective is to equal, at least at altitude, the overall specific fuel consumption of the piston engine with far better reliability at the same percentage power.

(4) *Bearings and Air Seals*.—The bearing problem in the turboprop may easily be specific to the engine type and therefore some of my remarks may not have a general application. One fundamental we have learned is the need for accurate alignment. Using normal methods of manufacture the out-of-alignment figure may be around 0.012in to 0.014in. We have proved quite conclusively that these figures have to be held to 0.002in to 0.004in. Radial dowelling and accurate machining can give these tolerances without individual unit treatment—that is to say, interchangeability can be achieved. If tolerances in excess of the figures mentioned are allowed, bearing and (particularly) cage wear ensues and also the inherent vibration causes failures of engine parts—combustion ware in particular.

With good alignment, adequate oiling, slack clearance (of the order of 0.003in to 0.004in), adequate ventilation and freedom from hot gases, and a conservative loading compared with catalogue figures, our bearing problems have disappeared.

We adopted the electronic ball-tester machine for ball-bearing selection as we find this is effective in eliminating bearings which have inherent faults not detected by normal inspection methods.

As regards air seals throughout the engine we believe we know how to make these efficient and reliable. In general, we use a system similar to that shown in Fig. 8. We aim to have the outer static member manufactured in low-conductivity material and the inner member in high-conductivity metal. The aim here is so to arrange the materials that in the event of a rub the outer member tends to expand away from the rotating part.

Controlled thicknesses of the rotating ribs is essential, 0.010in thickness being of the correct order. The rotating part must be located radially on the shaft so that expansion can occur while concentricity is retained.

(5) *Gearing*.—The design and development of a suitable high-speed reduction gear for the airscrew turbine unit was not as easy a job as making a reduction gear for an electric motor. The main problem was one of high-frequency vibration caused by the actual gear teeth on the (high-speed drive. The frequency was of the order of 5,500 cyc/sec. The introduction of helical gearing has eliminated the excitation, although the frequency is still there. These high-frequency periods caused irritating failures, not only of the gears themselves but of lock washers, split pins, oil jets, bolts and studs. We have had to establish, for instance, the maximum free length of studs and bolts. To quote one example, a $\frac{1}{4}$in diam bolt must not have a free length exceeding 2in.

With adequate lubrication of the bearings, care and attention to the lineability of the gear shafts, we do not anticipate any major problems with the reduction gear on the Dart engine.

Fig. 6. Latest design of high-pressure blades with extended roots (left) and their nozzle guide-vanes.

The type of gearing we use involves the accurate timing of the three layshafts. This is achieved by an adjustment of the shafts themselves and in practice has been found to be a simple operation. The gearing is of course, that

Fig. 7. (right). Introduction of cooling air through blade roots.

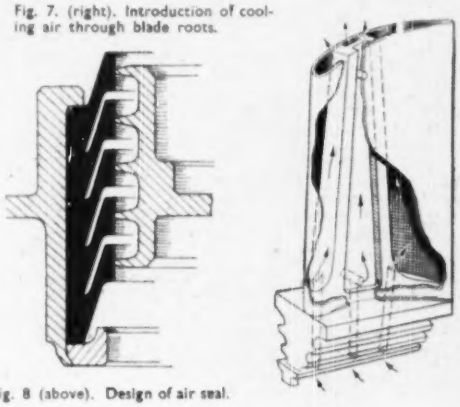


Fig. 8 (above). Design of air seal.

The general capabilities of the helicopter have often been demonstrated during recent years. With the rescuing of wounded, the sick, or the stranded, from out-of-the-way or inaccessible places, the helicopter has frequently proved to be the only efficient answer to cases of emergency. The "Bristol" Type 171 is a 4/5 seater helicopter designed to permit optimum utilisation in civil, industrial or military spheres. With a sound basic design, it provides full scope for modification to suit specialist requirements. Although Type 171 is the first "Bristol" helicopter, an unmatched record of forty years of aeronautical experience is the background to its design and construction.

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THE LIFE of a TURBOPROP . . .

part of the engine which determines the type of oil we use. At the present time the specification is D.E.D.2479 but this lubricant has very definite limitations, particularly as regards cold-weather operation. We are unable to dilute the lubricant under severe cold weather conditions, as is done on the piston engine, and we have, therefore, to select an oil which will flow down to the limiting requirements of −40 deg F (−40 deg C) and still retain the lubricating qualities over the whole temperature range.

Various samples of oil with additives have been examined from time to time, but we have not yet found an oil which, while giving high lubricating qualities at the maximum operating conditions of the engine retains these properties down to the low-temperature condition. There is a very definite need for a synthetic oil retaining load-carrying capacity over the complete temperature range.

(7) *Making Two Engines Alike.*—In general it is difficult to ensure that a line of production engines going through a works will all come out of the door identical. The repercussions of the variations in manufacture are likely to be hidden until the engine is in the operator's hands. I do not think that the turboprop will differ in this respect from piston engines.

It is realized that an unscheduled engine change is worse from an airline point of view than a reduced overhaul period. Consistent manufacture is mentioned because it is so very important for long life. Once the specification of the engine is settled, the maintenance of a supremely high standard of manufacture is absolutely essential.

Overhaul Costs.—Any very definite figure for overhaul costs it is impossible to give at the present time, due to lack of operating experience on the actual engine. At the risk of having to eat my own words at a later date, some indication of where we are going is, I think necessary.

The S.B.A.C. piston-engine formula is based on 20 per cent of the first cost of the power plant per overhaul. The indications are that for the turboprop it will be 20 per cent of the cost of the bare engine if the overhaul is carried out by Rolls-Royce, Ltd. The increase is not occasioned by the frequency or quantity of replacements but mainly due to the price of materials needing replacement. Comparative reduction in normal maintenance will, we hope, partly offset the overall effect.

(To be concluded)

KING'S CUP ENTRIES

A Total of 42 for the Classic Race to be Held Next Month

IN last week's issue (page 515) we gave details of some of the 42 entries for the King's Cup Air Race, which will take place on Saturday, June 17th, over a course 100 km in length centred upon Wolverhampton Airport.

King George V gave the first King's Cup in 1922, and prior to that the annual event had been known as the Circuit of Britain Race. The series has been held over a variety of courses, and the distances have also varied considerably.

Winners, times and distances in past years included: 1922, F. L. Barnard, D.H.4A, 123.5 m.p.h., 810 miles; 1923, Frank Courtney, Siskin, 149 m.p.h., 794 miles. Sir Alan Cobham won in 1924 and Barnard again won in 1925, his speed in the Siskin being 141 m.p.h. over a course of 1,626 miles. D.H. Moths flown by Capt. Broad and W. L. Hope won the 1926 and 1927 events at a little over 90 m.p.h., but in the following year Hope, again flying a Moth, managed to average 105.5 m.p.h. In 1930 Miss Winifred Brown, flying an Avro Avian and averaging 102.7 m.p.h., won over a course of 750 miles. There were 88 starters that year. Once again, in 1932, Hope won a handicapped event in a Fox Moth, averaging no less than 125 m.p.h. Sir Geoffrey de Havilland flew a Leopard Moth to victory in 1933, his speed being 139.5 m.p.h. F/L. H. M. Schofield, in a Monospar ST10, won at 148 m.p.h. in 1934. In 1935 aircraft types which are entered in this year's Race made their appearance among the winners. Tommy Rose won in a Miles Falcon at 176 m.p.h., F/L. H. R. A. Edwards was second in a Miles Hawk Trainer, averaging almost 158 m.p.h., and Cathcart-Jones was third in a similar machine. In 1936, 1937 and 1938 the winner and their aircraft were C. E. Gardner, Percival Vega Gull, 164½ m.p.h. over 1,536 miles; 1937, the same pilot, this time flying a Mew Gull at 233.7 m.p.h. over 786 miles; and 1938, Alex Henshaw, Mew Gull, 236 m.p.h.

The Royal Aero Club has now compiled the official list of entries which have been accepted for this year's Race, as given below.

No.	Entrant	Pilot	Aircraft	Engine(s)	Reg
1	A. J. Linnell	A. L. Cole	Comper Swift	Pobjoy R	G-ABUS
2	R. E. Clear	R. E. Clear	Comper Swift	Pobjoy R	G-ACTF
3	G/C. A. H. Wheeler	G/C. A. H. Wheeler	Auster Vb	Gipsy Major 1	G-ALKI
4	W. H. Moss	W. Moss	Messerschmitt MA.2	Niagara III	G-AEST
5	W. H. Moss	H. Moss	Messerschmitt MA.4	Cirrus Minor I	G-AFMS
6	Maj. R. E. Young	Maj. R. E. Young	Hawk Trainer III	Gipsy Major I	G-ALIO
7	J. H. Ashton	J. H. Ashton	Hawk Trainer III	Gipsy Major I	G-AHNV
8	R. H. Young	C. A. Negean Bishop	Hawk Trainer III	Gipsy Major I	G-AIUA
9	D. M. Brown	D. J. Jemmett	Hawk Trainer III	Gipsy Major I	G-ALOG
10	E. A. Ross	E. A. Ross	Hawk Trainer III	Gipsy Major I	G-AIYD
11	Miss M. Wigram	C. J. de Vere	Hawk Trainer III	Gipsy Major I	G-AJDR
12	H. T. Ryan	H. T. Ryan	Hawk Trainer III	Gipsy Major I	G-AHNW
13	H. E. Scrope	H. E. Scrope	Hawk Trainer III	Gipsy Major I	G-AIUE
14	E. Day	E. Day	Hawk Trainer III	Gipsy Major I	G-AKRV
15	R. A. Walley	R. A. Walley	Hawk Trainer III	Gipsy Major I	G-AHNU
16	D. Lowry	D. Lowry	Christen CH.3-IV	Cirrus Major III	G-AKVS
17	Lady Margaret Stewart	R. Rumbold	Miles Whitney Straight	Gipsy Major I	G-AEVL
18	D. E. Bianchi	D. G. S. Coxer	Miles Falcon	Gipsy Major I	G-ADFH
19	E. W. Westbrook	E. W. Westbrook	Messenger IVa	Gipsy Major M.	G-ALBE
20	W. P. Bowles	W. P. Bowles	Messenger Ia	Cirrus Major III	G-AKBN
21	G. C. Marler	G. C. Marler	Messenger III	Cirrus Major III	G-AGOY
22	R. G. Pilkington	R. Porteous	Miles M.18 Mk. II	Cirrus Major III	G-AHOA
23	E. W. Phillips	L. S. Loveridge	Hawk Major	Gipsy Major I	G-ACYO
24	D. C. Jemmett	D. C. Jemmett	Hawk Trainer III	Gipsy Major I	G-AKPE
25	E. A. Taylor	Mrs. M. M. Rendall	D. H. Rapide	2 Gipsy Queen III	G-ALBB
26	Lt. Cdr. J. G. Crammond	Lt. Cdr. J. G. Crammond	Fairnall Heck IIc	Gipsy Queen III	G-AEGI
27	F. Dunkerley	F. Dunkerley	Gemini Ia	2 Cirrus Minor II	G-AKKB
28	P. R. L. Rowley	P. R. L. Rowley	Gemini Ia	2 Cirrus Minor II	G-AJWE
29	E. F. Wild	E. F. Wild	Gemini Ia	2 Cirrus Minor II	G-AKFU
30	Lady Sharborne	Lady Sharborne	Vega Gull	Gipsy Six II	G-AFBC
31	Dr. D. F. Little	Dr. D. F. Little	Vega Gull	Gipsy Six II	G-APEA
32	J. E. Rylands	W. L. Lashbrook	Proctor I	Gipsy Queen II	G-AHID
33	F. Weir-Willats	F. Weir-Willats	Proctor V	Gipsy Queen II	G-AIET
34	D. J. Bennett	D. J. Bennett	Proctor V	Gipsy Queen II	G-AHGR
35	S/L. J. Rush	S/L. J. Rush	Miles Falcon Six	Gipsy Six I	G-AECC
36	J. N. Somers	J. N. Somers	Gemini III	2 Gipsy Major Ic	G-AKDC
37	C. G. Alington	C. G. Alington	Sparrow-hawk	Gipsy Major 1 MC	G-ADNL
38	R. R. Paine	R. R. Paine	Hawk Speed Six	Gipsy Six II	G-ADGP
39	Dr. J. Williamson	N. E. Waugh	D. H. Dove	2 Gipsy Queen 70	VR-TBB
40	W. S. Shackleton	Miss R. M. Sharpe	Spitfire 5b	R.R. Merlin 55M	G-AISU
41	H.R.H. Princess Margaret	G/C. P. Townsend	Hurricane IIc	R.R. Merlin 20	PZ.865
42	P. G. Roberts	P. G. Roberts	Spitfire Trainer 8	R.R. Merlin 66	G-AIDN

HIGH-ALTITUDE INTERCEPTION

What the Defending Fighter Must Face : Are Guided Missiles the Answer?

By G. McINTOSH

SOME experts hold that total destruction of all enemy bombers is the only possible defence in an atomic war. Whether this is true or not is beyond the scope of this small venture in crystal-gazing, as the published data is too scanty; but, as it is as well to err on the safe side, we will take it that every enemy bomber must be stopped. I have assumed that the bomb will be delivered by a bomber, for the following reasons.

It has been calculated that to produce one atomic bomb requires the same effort as is involved in making an equivalent destructive load of normal high-explosive bombs, namely, about 2,000 tons. Hence, even a country as powerful as America is not going to be able to scatter them indiscriminately. If this is true, the stockpile at the start of a war would consist of hundreds, not thousands of bombs, and it would take at least a year to replace them.

IN our issue of April 6th, W/C. E. Caten, D.F.C., A.F.C., A.F.R.Ae.S., discussed the new problems of defence with which technicians and tacticians are faced as a result of the development of the high-speed, high-altitude jet bomber. He concluded that interception methods as we have known them in the past are largely a dead letter, and that a new approach must be made—perhaps by the use of the ground-to-air guided missile.

In the present contribution—which is not in any way a commentary on the previous article—another writer gives his opinions on this controversial subject. He, too, thinks that guided missiles may be the solution, and suggests some design features

This is, of course, merely a rough guess, but even so it is accurate enough to indicate the probable use that would be made of the bombs. Each bomb would have to do the maximum amount of damage to the enemy, by destroying either towns or vital installations. The latter seems most likely, since during the last war it was considered that the bomber effort would have been better used against things like oil, or transport, rather than in area-bombing of towns. When it comes to actually dropping the bomb, one again has to do guessing, as reports are so varied, some saying the atom bomb must be accurately placed to be effective (at Nagasaki the destruction is supposed to have been localized by small hills) and others the reverse. If the first view is true, and the bomb must be accurately aimed, it is not a job for rockets or robot-navigated missiles, and the only sure means of delivery is a piloted aircraft.

Working on this assumption, the next thing is to decide on the type of bomber we would have to deal with if, in a few years' time, this country was being attacked by some power which had occupied the whole of Europe. Since the enemy would have a much longer perimeter to defend, he would not be able to provide a complete defence screen, so that by means of intruders, rather like the "Rats" in the recent *Foil* exercises, we could force his bomber airfields far enough away to prevent the use of small supersonic bombers. The bombers would then be rather after the style of the B-47 Stratojet, cruising somewhere about 50,000 feet at speeds just below the speed of sound, and being capable of short bursts at supersonic speeds. The bomber would not, one imagines, fly faster than sound all the time, as the fuel consumption would be prohibitive; but it is quite on the cards that afterburning, or something of the kind, could be kept in reserve to boost the speed.

Having thus forecast the type of bomber likely to be seen in three or four years' time, we will now see what it means in terms of interception. As the bomber will be flying at over 40,000 feet, the earliest possible radar warning will be given when it is roughly 150 miles away. This distance may be increased if use is made of airborne radar warning-posts—rather on the lines of the special Constellation the Americans have developed—but as this might be annulled by aircraft loss or unserviceability we must assume that the ground warning system is the only one operating. I am also going to neglect bombers flying at lower altitudes, since they are much easier targets from the interception point of view. If the bomber is spotted at 150 miles, then the warning period is only 15 minutes, in which time it must be identified, its course plotted, action decided on by the defending controller and fighters scrambled and vectored; then, finally, the fighter has to shoot the bomber down. All this seems rather a lot to get through without a hitch in such a short time—rather too much if there are to be no mistakes, especially where one slip in the chain of action is likely to mean the end of a town the size of Coventry.

Taking the individual items in this time-table and looking at them more closely, the narrow margins allowed if the operation is to be a success become even more evident. Control, I believe, requires about five minutes between sighting and the scrambling of the fighters, if they are to have any idea of the enemy's intentions. With the high fuel-consumption of jet fighters, and even more so for possible future rocket intercepters, there is not much chance of this figure being cut down, as the defenders will not have sufficient endurance to allow them to stand off while the controller decides where they are to go. They can be alerted earlier, however, so that as soon as the order to scramble is given they will be off. At the moment we have fighters which can climb to 40,000 feet in eight minutes, so that in a year or two specialized intercepters using rocket boosters should be able to get to 50,000 feet in five minutes from take-off. By this time the bomber is 50 miles from the coast, where it could be intercepted if the fighter had a climbing speed of 600 m.p.h. Not too fantastic a figure at the present rate of development! Adding those factors, we find that the fighter has 50 miles and five minutes for the kill, so now we will see what this entails.

Manœuvrability Limited

In the past, one of the fighter's main advantages over the bomber has been its greater manœuvrability; the balance of fire-power and speed has swayed to and fro, but the fighter has always managed to keep ahead in manœuvrability. Now, however, the bomber is winning a lead in manœuvrability by flying at high altitude, where the fighter is limited to normal accelerations of roughly the same order as its target. This limitation is due to the convergence of the stalling and compressibility limits at altitude increases. Though this situation is likely to be eased slightly when supersonic fighters come into service, the increase may not be enough to give the fighter the margin it needs to guarantee a kill, for the attacking aircraft has to turn "inside" the target to keep it in its sights, thus suffering a higher acceleration. To keep in its sights a high-speed bomber in a 2*g* turn, the fighter would have to apply up to 5*g* in a stern attack, and something like 8*g* in a head-on attack. The *g* restriction crops up again if the first attack fails and the fighter has to go round again, as the fighter has to make a wide, sweeping turn which means that the next attack will have to be made twenty miles farther on. This would not matter much if the fighter was practically able to guarantee a kill at the first attempt; but, even with improved gun-sights this is not very likely to be certain. If radar gun-laying was used the accuracy would probably be greater, but this increase in accuracy would only be effective if there was sufficient fire-power to saturate the target area, and could be used only from a dead-steady firing platform. It would be unfortunate for

the pilot who ran into some high-altitude turbulence just as he was making an attack; it might even be that dangerous turbulence would be met in any stern attack, as several American fighters have been broken up by turbulence behind large bombers. As though these high-altitude problems were not enough, nature has added another in the form of a very dark blue sky which makes it difficult to spot an aircraft even at a mile or two off. That means all fighters would have to carry radar to find the target, as they would need to "see" it at a minimum range of somewhere about six miles to give them time to get in position for a successful attack.

So far we have dealt only with mechanical problems. Aircrew conditions produce fresh complications in the form of pressure cabins, heating, escape facilities, etc., all of which seem to be only partly solved at the moment. There is one other point I have not seen mentioned, and that is a psychological one: to date there are no published reports on the effect of cannon shells on atom bombs, but I do not think it would take much imagination to make a pilot think twice before he fired at a bomber. This may turn out to be an important factor, as it would change a normal attack into rather a suicidal sort of affair, reminiscent of the Japanese *Kamikaze* attacks.

Problem for the Guns

That may be rather a pessimistic summary of the problems facing the conventional intercepter fighter; but it is, perhaps, accurate enough to show that, even if there was a great improvement, 100 per cent interception could not be guaranteed. At the moment the only other alternative is A.A. fire, and here the 100 per cent figure is even less likely to be obtained. Right from the start it involves the disadvantage that most of the bombers shot down will fall on land—our own. This applies to other methods as well, but not in quite such a pronounced degree. Apart from this, the accuracy is not great enough, even though radar gunlaying and proximity fuses of much greater accuracy than the present types would be used. Operating against the flying bombs, on two weeks towards the end of the attack, the guns were able to destroy 74 per cent of the targets. This is quite a good figure, but now we have to compare a fairly slow-speed robot (flying at a constant height and fairly low down) with a high-speed jet bomber taking avoiding action at 50,000 feet. Against the flying bomb another point in favour of the guns was the fact that all the targets were coming in over a narrow front in roughly the same direction. On the other hand, jet bombers would be coming in all over the place, giving no chance for the guns to concentrate. Thus it seems that normal A.A. will have nothing like the accuracy we are looking for, apart from its waste of manpower.

Having written-off normal fighters and A.A. as not being certain enough, the only alternative is the guided missile. Fortunately, this looks like filling the bill more completely. It is really the logical development of the fighter, with a little A.A. thrown in for good measure if it is ground-launched. In the modern high-speed fighter the pilot is little more than the means of interpreting the readings on all his instruments and of then pressing the right button; so, if we replace him by an electronic computor we finish up with a guided missile. This is a much more efficient way of doing things, as all the responses can be calculated and set permanently, whereas the pilot's judgment and reflexes depend quite a lot on what he had for breakfast, or on how good the party was the night before. A whole host of troubles disappear with the removal of the pilot; to mention only a few, there is no pressure cabin, no windscreen, no need for landing facilities—in fact, none of the odd gadgets needed to keep a human being comfortable in body and mind. This leads to quite a saving in weight and drag, but perhaps the greatest saving comes in the expendability of the whole thing: there is no need for landing gear, and everything needs only to last one trip. A life of only one operational flight may seem wasteful, but one has to remember that the present highly expensive fighters are designed for a life of only 200 hours, and that the still costlier bomber is usually intended for no more than 50 operations.

Taking guided missiles in general, the most expensive item would be radio, with airframe and power plant far behind as far as cost and labour were concerned. As the radio equipment will be identical for several hundreds of thousands of units, it should be possible to make it by mass-production methods as already used in commercial radio-set production. The power plant would almost certainly be a simple type of liquid-fuel rocket rather like those the Germans were working on towards the end of the war.

Apart from the aerodynamic design, the airframe should present no trouble, as sizes would be small and simple types of monocoque construction could be used, possibly using moulded plastics with metal reinforcement moulded in. Mass-produced missiles like this would work out at only a fraction of the cost of a fighter—say, £4,000 each, not that actual cost matters much in a war, but it is a measure of productive effort, and that does matter. In the recent conflict, when the fighter was on top one fighter was lost for approximately every five bombers shot down, so we could say that it took a fifth of a fighter to destroy one bomber. The figure of 500,000 dollars has been quoted as the price of an F-86, so that even allowing for a 50 per cent error in this figure we could have 30 missiles for one F-86, with each missile having a better chance of success than would the fighter. Production engineers may not agree with all these statements, but they are probably near enough to the truth for the purposes of this survey.

So much for "produceability"; now for the actual missiles themselves, and the way in which they would have to be used. Very high speed—Mach 2 at least—seems to be indicated, both to give the bomber less chance of taking evasive action and to enable the missile to manœuvre on to the target. It would be fitted with a homing device, effective in, say, a 30 deg cone at a couple of miles, so that extreme accuracy would not be needed in the initial aiming. This would mean that turns would have to be made at up to 6 or 7 *g* to keep on the target, but here the missile's high speed would enable it to get sufficient lift from its stub wings in spite of the low C/L max. at the high Mach number.

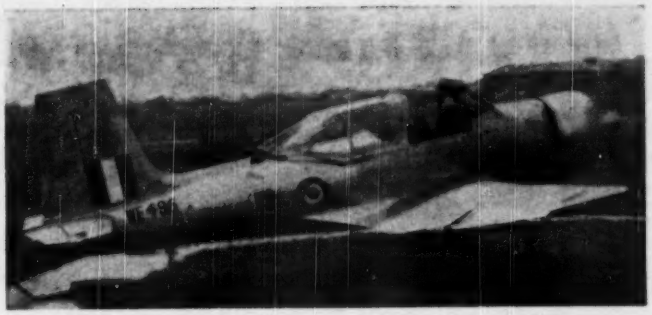
Thrust and Parry

The bomber may try to dodge by flying in a continuous zig-zag as it neared the coast, so the missile may have to have some sort of analyser fitted to work out the target's course and lay off to allow for it. This would probably be possible, as the bomber would be on an autopilot flying along a fixed sine wave, as a human pilot could not corkscrew and still fly an accurate course. If a homing device were fitted to the missile the bomber would probably try radar jamming, but this snag would crop up with a fighter's set, so we would be no worse off; in both cases better radar would be needed. To allow for the small area of actual target a proximity fuze would probably have to be incorporated in the homing device, so a direct hit would not be essential. Using this idea, the warhead would have to be of the fragmentation type, as blast would not have the same effect on the thick skins of a supersonic bomber as it would on present-day types. It may be argued that control surfaces would be vulnerable, but we have to cater for the use of spoiler types of control surfaces, where the construction would be much stronger due to the higher loads imposed on that type of surface.

The missiles would be launched either from the ground, using a powder booster-rocket, or from an aircraft cruising high up about 50 miles off the coast. The air launching would be merely an attempt to dispose of as many raiders as possible before the coast was reached, the ground-launched missiles being the main defence. The missiles would be sent off in groups of two or three, and at intervals sufficient to prevent one homing on the other, thus giving a better chance of a hit. Air launching might involve exchanges of missiles, with the bomber sending out smaller defending missiles; but, since the defending aircraft would specialize in the duty it should come off best.

If these arguments are accepted, it seems fairly obvious that the best defence against atomic bombers is the guided missile—apart, of course, from political methods.

HERE and THERE



NOW FLYING: First view of the Handley Page (Reading), Ltd., H.P.R.2 basic trainer, with Armstrong Siddeley Cheetah 17, which has made its first flight at Woodley. Quick take-off and low stalling speed are reported. The H.P.R.2 is of all-metal construction and is designed for "split production," which allows maximum manpower to be concentrated simultaneously on many assembly jigs. The entire dual-control cockpit can be inspected, and its contents maintained, through floor panels.

Bristol 175 Named

THE type-name Britannia has been selected for the Bristol 175 airliner, designed for medium-range service on B.O.A.C.'s Empire routes. Carrying 50-62 passengers, and powered by four Bristol Proteus turboprops (Centaurus piston engines, intended to power the first versions, will not now be used), the Britannia's estimated cruising speed is 339 m.p.h. for 2,647 miles.

One Fall Swoop

AT Villacoublay Airfield, Paris, last Sunday, Sgt.-Maj. Leo Valentin, of the French Air Force, demonstrated controlled descent from 13,000 to 1,800ft with the aid of fabric "wings." He used a parachute for the final descent and landing. Similar exhibitions were given before the war by Clem Sohn, an American, who was killed in 1937 when his two parachutes malfunctioned.

Weighty Freight

BELIEVED to be the heaviest piece of engineering equipment ever carried by an aircraft at one loading, a mud pump weighing 11,000lb was recently transported from Shell Mera to Villano, in Ecuador, in a Bristol Freighter operated by the Shell Company of Ecuador. It was flown over dense jungle to the site of a new oil well, inaccessible by any other means of transport.

On the Importance of Unity

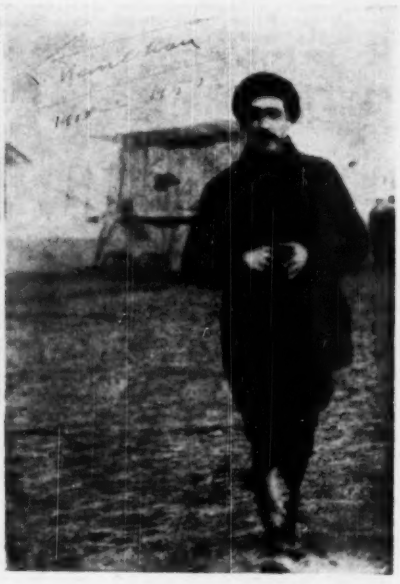
"IF all the Atlantic Treaty powers stand put on their traditional military sovereignty and try each to build up what are euphemistically called 'balanced forces' of their own—a lot of little national replicas of what should be the overall military establishment of the Atlantic Treaty—we shall never get anywhere."—The Chief of the Air Staff, Air Chief Marshal Sir John Slessor, in his reply to the toast "The Armed Forces of the Crown," at the Royal Academy Banquet on April 27th.

Remaining D.H.108 Lost

SQUADRON LEADER G. E. C. GENDERS, A.F.C., D.F.M., a test pilot of the R.A.E., Farnborough, lost his life last Monday when a D.H. 108 research aircraft crashed near Basingstoke, Hants. The aircraft was the first of three D.H. 108s built originally to investigate the characteristics of swept-back wings at high speed, and was the sole remaining example. It was built round a modified Vampire fuselage and flew at lower speeds than the two later prototypes, one of which was the first British aircraft to exceed Mach 1.

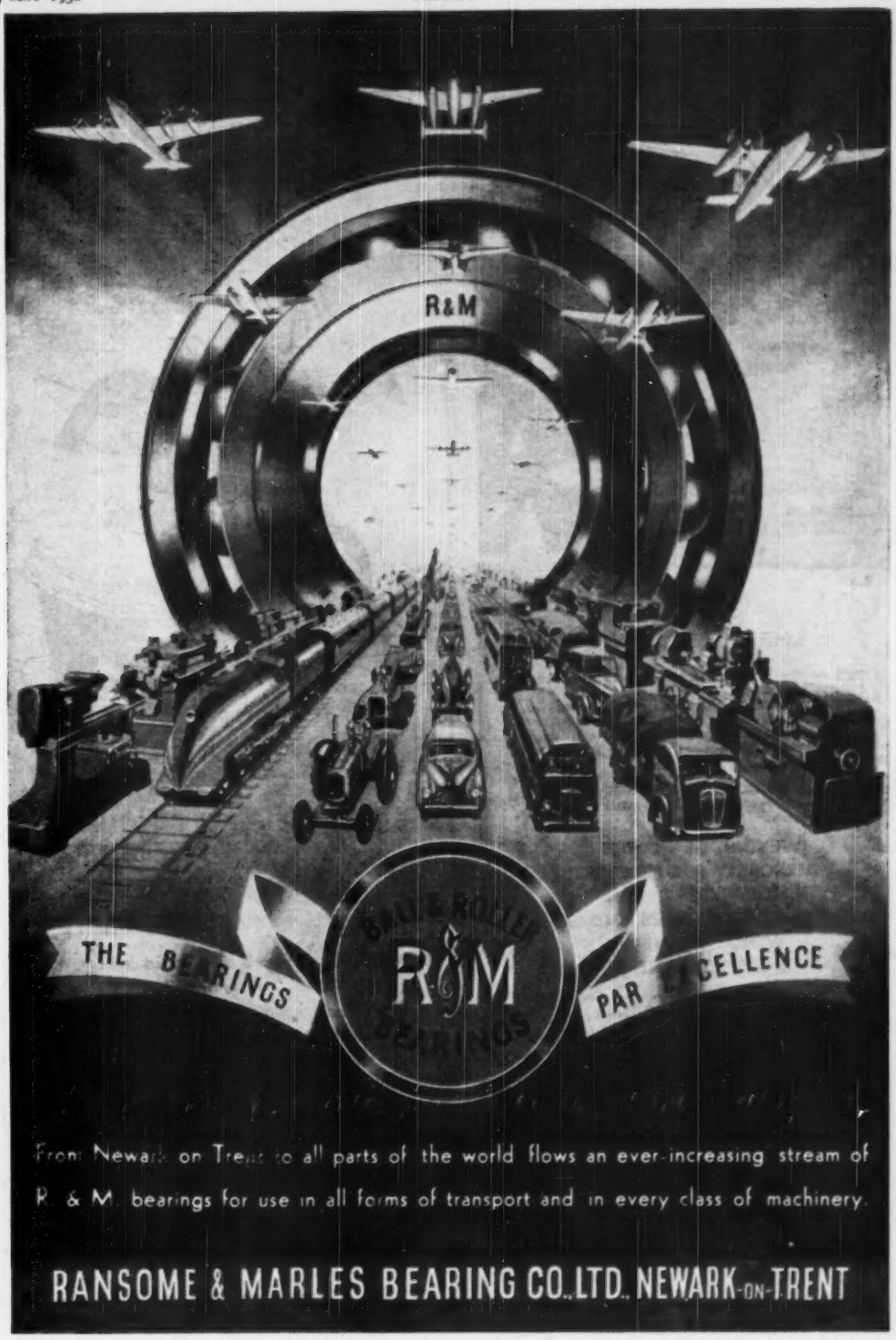
White Waltham at Whitsun

THE three Services are giving their support to what promises to be a first-class display at Fairey's White Waltham airfield on Whit Monday, May 29th. Organizers are the Soldiers', Sailors' and Airmens' Families Association, and the programme (in three sections) begins at 2 p.m. In the first part, several civil aircraft will be demonstrated, including the Prince feederliner and the Eon sailplane. The second section will comprise ground events, including a motor cycle display by the Royal Signals and a demonstration by R.A.F. police



"Flight" photographs.

COVERING OLD GROUND: The story of Claude Grahame-White's gallant failure in 1910, when he attempted the London-Manchester flight for the £10,000 *Daily Mail* prize, was told in *Flight* of April 20th. He was beaten by the Frenchman, Louis Paulhan, whose Farman took 12 hr. 10 min. over the trip. On the 40th anniversary of the flight, last Thursday, M. Paulhan, who kindly inscribed the 1910 *Flight* photograph reproduced on the right, covered the same ground in a Gloster Meteor 7 in 24 min. Test pilot Jim Cooksey, seen on the left initiating the French pioneer into the mysteries of mask and helmet, was the pilot.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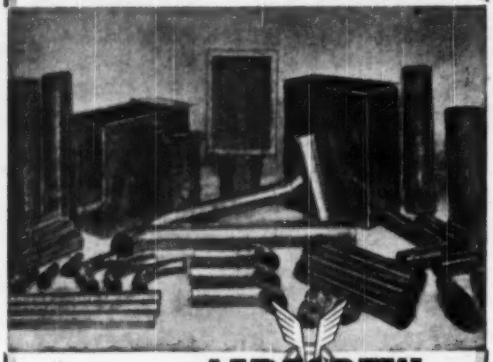

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HERE AND THERE . . .

dogs. Finally, there will be a flying display including aerobatics by Meteors, demonstrations by Sea Furies, parachute jumping, and a visit by U.S.A.F. B-29 and B-50 bombers. A static exhibition will show some of the work of the R.A.E., Farnborough. Special train and bus services, some at reduced rates, have been arranged.

Sympathetic Audience

MEMBERS of the staff of Blackburn and General Aircraft, Ltd., provided a marine-conscious audience for Mr. H. Knowler, director and chief designer of Saunders-Roe, when he lectured recently before the Brough branch of the Royal Aeronautical Society on design problems of flying boats. Mr. Knowler expounded the case for flying boats versus landplanes, and cited figures to prove that size was an advantage and not a limitation in this class of aircraft.

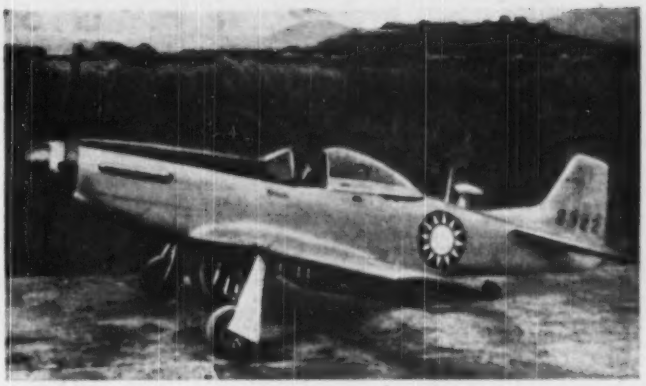
Air League Cup Race

FOR this year's Air League Race, to be held at Sherburn-in-Elmet, near Leeds, on Saturday, July 22nd (the S.B.A.C. Challenge Cup Race will also take place on this occasion) an alteration has been made to Regulation No. 2. This now reads: "*Aircraft.*—The Race is open to any type of piston-engined aircraft of any nationality, entered by any individual, organization, firm or company, provided that the maximum speed at sea level exceeds 150 m.p.h."

Another Airship?

IF enough support is forthcoming an airship club may be formed in Sussex, with headquarters at Shoreham Airport, by Mr. E. H. Wood, who was an airship pilot in the First World War. Mr. Wood hopes that the airship may be built and housed at Shoreham, and believes that it would eventually be possible to offer joy rides to visitors.

An airship club, under the chairmanship of Lord Ventry, has already been formed at Bournemouth and is building the first dirigible seen in Britain for 20 years. It will be completed before the end of the year; speed will be approximately 50 m.p.h., range 500 miles and capacity 45,000 cu. ft.



NATIONALIST: A North American Mustang of the Chinese Nationalist Air Force starts up for a low-flying attack on Communist-held Shanghai, 70 miles distant from its base on Chusan Island. The Mustang—one of the finest fighting aircraft of World War II—continues in the service of many nations, including France, Australia, and Sweden.

NEWS IN BRIEF

CANADAIR, LTD., announce the appointment of Mr. B. D. Russel as assistant sales manager and of Mr. Erik Nelson as a sales representative. Mr.

Mr. B. D. Russel. Mr. Erik Nelson

Russel, while in the R.C.A.F., served with the famous No. 1 squadron and was awarded the D.S.O. and D.F.C. and Bar. Mr. Nelson joins Canadair from B.O.A.C., where he was operations director for the Atlantic Region; previously he had held a number of senior posts with B.O.A.C. and during the war had a responsible share in the operation of Atlantic services, both as a serving R.A.F. officer and in civil posts.

* * *

The date of the fifth annual rally of the St. Albans Model Aero Club is Sunday, July 23rd, and not May 17th as inadvertently quoted last week. The venue is the Handley Page airfield at Radlett.

* * *

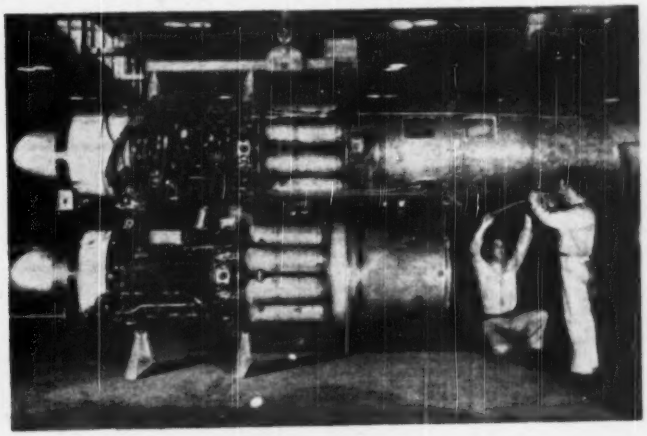
Special-purpose industrial adhesives, principally compounds, based on rubber and latex, are the subject of a new catalogue, *Adhesives and Compositions*, issued by Dunlop Special Products, Ltd., Fort Dunlop, Birmingham, 24, from whom executives may obtain copies.

* * *

Dr. H. Roxbee Cox, who is now Chief Scientist, Ministry of Fuel and Power, is to give the 1950 May lecture to the Institute of Metals at the Royal Institution, Albemarle Street, London, W.1, at 6 p.m. on Wednesday, May 10th. His subject will be "Industrial Gas Turbines." Admission is without ticket, and visitors will be welcome.

* * *

The new president of the Aluminium Development Association is Mr. Edward Player, managing director of Birmid Industries, Ltd., joint managing director of Birmingham Aluminium Casting (1903) Co., Ltd., chairman and joint managing director of Birmetals, Ltd., managing director of Sterling Metals, Ltd., and chairman of Perry Barr Metal Co., Ltd. Mr. E. Austyn Reynolds, of T.I. Aluminium, Ltd., has been elected A.D.A. vice-president and Mr. F. G. Woollard re-elected as chairman of the executive committee.



THERE'S A LONG, LONG TAIL—: Elongated as it is by the addition of an afterburner, the uppermost General Electric J-47 turbojet is not wholly in the picture: cut off by the camera is the adjustable tailpipe-nozzle, a well-nigh indispensible adjunct to the afterburner. A standard unit, with normal tail cone, is presented for comparison.

THE R.A.F. DISPLAY

Preliminary Details of Programme Announced : Promise of a Sustained Spectacle

THE Royal Air Force Display, to be held at Farnborough, Hants, on July 7th and 8th, will be the first full-scale demonstration by the Service since the 1937 event at Hendon. As already announced, Their Majesties the King and Queen will attend during the afternoon of Friday, July 7th.

Compared with pre-war events the programme is wider in scope, and includes items which promise to be most spectacular. The Display will start at 10.30 a.m., will last until 5.30 p.m., and consist of 27 events. The ten morning events will include six devoted to ground activities, but all seventeen in the afternoon will be flying items. These latter will include individual and formation aerobatics by Meteors and Vampires; fly-pasts by large formations, and by representative aircraft drawn from 35 Regular and Auxiliary squadrons; "crazy" and precision formation flying by instructors; a helicopter circus; and demonstrations by a Venom and a Canberra (both are in production for the R.A.F.), and by two research aircraft.

There will be flights by aircraft dating from the 1914-18 war and by a modern high-performance sailplane. One of the highlights will be a reconstruction of the attack on Amiens prison in February, 1944, when by breaching the prison walls in a low-level attack, a formation of Mosquitoes liberated French patriots under sentence of death. Among events illustrating R.A.F. operational techniques will be an assault on a strong-point by armoured cars of the R.A.F. Regiment and by Vampire fighter-bombers. The defence of an airfield against an attack by Mosquitoes is also scheduled for demonstration.

Aerobatics will be performed by pilots selected by competition from the various squadrons and flying units. The finals of this contest are due to take place at North Weald on May 6th and 7th.

The Royal Auxiliary Air Force will be prominently represented. On the Friday the final of the Cooper Trophy high-speed handicap race—an annual event for the twenty R.Aux.A.F. fighter squadrons—will be flown and on the following day this event will be replaced by air drill, executed by two Auxiliary squadrons. The R.Aux.A.F. will also participate in the Amiens prison event and the fighter section of the fly-past. V.R. pilots will further demonstrate the aerobatic capabilities of their new de Havilland Chipmunks, and A.T.C. cadets will give a gliding display.

Ground events include a demonstration by R.A.F. police dogs, P.T. by the Women's Royal Air Force, mortar-firing by the R.A.F. Regiment and a mass physical training display by recruits. Nine R.A.F. bands, the Central Band of the W.R.A.F. and the massed bands of the A.T.C. will also take part in the morning programme. Between 9 a.m. and 7 p.m. there will be an R.A.F. static exhibition on the airfield.

Admission charges to the spectator enclosures will be 3s and 10s; individual seats in boxes will be available at 12s 6d, 15s and £1. Boxes to seat six will cost from £3 15s to £6. The admission charge for cars will be 10s, motor cycles 2s 6d, and bicycles 6d. The parking charge for coaches will be £1. Tickets will be available from May 15th from Alfred Hays, Ltd., 26, Old Bond Street, London, W.1, and from the usual agencies.

BOOST FOR STRATOCRUISER

AT a recent airport operators' meeting in Cleveland, Ohio, Mr. Donald Buck, a Boeing engineer, mentioned plans for increasing the take-off and cruising performance of the Stratocruiser by adding two turbojets (presumably in the underwing "pod" installations) outboard of the four Wasp Major power-units. The aircraft's cruising speed, said Mr. Buck, would then be increased to 360 m.p.h. Its take-off weight would be 153,000-165,000 lb. Despite the obvious advantages of such modification, quick calculations indicate that the Stratocruiser's wing loading—already high at 80.5 lb/sq in—would be raised by as much as 15 lb/sq ft.

EXPORTS AND IMPORTS

THE disappointingly high ratio of aircraft imports to exports, which has risen in the last three years from approximately 12 per cent to over 50 per cent, still shows no sign of falling. In analysing the March figures, the S.B.A.C. points out that the higher rate at which direct-sale exports appear to be running this year are likely to be somewhat offset in the ultimate 1950 totals by the falling-off in inter-government transfers, which were at their peak last year.

Exports for last March totalled £3,429,985, while imports totalled £2,188,388. These figures are made up as follows:—

Exports	£
96 complete aircraft	1,754,038
176 engines	596,514
1,020 rubber tyres	30,933
Accessories	1,048,486
	£3,429,985

Imports	£
8 complete aircraft	1,374,074
Accessories	814,314
	£2,188,388

In addition, six aircraft were imported temporarily, for repair and re-export.

Quarterly Export Totals

Quarter	1947	1948	1949	1950
	£	£	£	£
1st	3,748,036	7,115,729	9,377,091	8,939,396
2nd	5,930,422	6,568,138	6,459,596	—
3rd	7,704,089	5,760,315	10,223,492	—
4th	7,377,881	5,608,525	8,154,998	—
Totals	£24,750,428	£25,058,707	£34,215,177	—

Annual Import Totals

1947	1948	1949	1950
£3,073,655	£5,595,031	£17,365,302	£4,876,233 (1st quarter only)

ANGLO-DUTCH EXERCISES

A DUTCH naval squadron returning from the West Indies will join with British sea and air forces in a combined exercise in the English Channel early this month. The squadron, consisting of the aircraft carrier *Karel Doorman*, the cruiser *Heemskerck* and the frigate *Johan Nassuns van Nassau*, will be under the command of Rear-Admiral J. L. Willinge.

On May 2nd, aircraft of R.A.F. Coastal Command set out to shadow and engage the squadron. An attack will be made by motor torpedo boats based on H.M.S. *Hornet*, Gosport, and by British naval aircraft operating from the South of England. The aircraft of the *Karel Doorman* will endeavour to intercept and divert all attacks. The Netherlands Commander-in-Chief (Vice-Admiral Jonkheer E. J. Van Holthe) flew to the Azores on April 27th to join the *Karel Doorman* for the exercise.

British naval forces will be under the direction of the C.-in-C. Plymouth, Admiral Sir Rhoderick McGrigor, K.C.B., D.S.O.

FORTHCOMING EVENTS

May	4.	R.Ae.S. : Third Louis Blériot Lecture, by Sir Frederick Handley Page, C.B.E., F.I.Ae.S., Hon. F.R.Ae.S. (in Paris).
May	7.	Veteran Car and Aircraft Display, Old Warden Airfield, Biggleswade, Beds.
May	14.	R.Ae.S. Garden Party, White Waltham.
May	16.	Aero Golfing Society : *Flight* Cup Meeting, St. George's Hill.
May	19.	Bomber Command Night, Royal Albert Hall.
May	19-21.	Air Tour of Sicily.
May	20.	Northamptonshire Aero Club : "At Home."
May	20-21.	Yorkshire Aeroplane Club : International Rally, Sherburn-in-Elmet.
May	25.	R.Ae.S. : 38th Wilbur Wright Memorial Lecture, by Sir Richard Fairey, M.B.E.
May	27-29.	Champagny Rally, Epernay-Plivot.
May	27-28.	Bembridge and Sandown Aero Club : Rally.
May	28-29.	Ailes d'Azur Rally, Cannes.
May	29.	West London Aero Club : S.S.A.F.A. Display, White Waltham.
June	2-4.	Tyrol Rally, Innsbruck.
June	3.	Derby Aero Club : "At Home" and Display.
June	3-4.	"Wines of Anjou" Rally, Angers.
June	3-4.	Ultra Light Aircraft Association : Rally, Fairwood Common.
June	4.	F.A.I. : General Conference, Stockholm.
June	4.	Aero Club of Normandy : Aerobatic Competition.
June	4.	Ragusina Trophy Navigation Competition, Rearsby.
June	10.	Blackpool and Fylde Aero Club : "At Home."
June	10.	Darlington Flying Display.
June	10.	Yorkshire Aeroplane Club : International Rally, Sherburn-in-Elmet, Leeds.
June	10-25.	Brussels International Aeronautical Exhibition.
June	11.	Fête Aérienne d'Orly, Paris.
June	15-18.	Benelux Air Tour.
June	16.	Institute of Navigation : "A Survey Flight to South Africa," by J. L. Cowan ; "Light-aircraft Navigation," by Michael Townsend.
June	16-19.	Aero Club de Roussillon : Perpignan Rally.
June	17-18.	Normandy Rally.
June	17.	Wolverhampton Aero Club : King's Cup Race.
June	18.	Wolverhampton Aero Club : Goodyear Trophy Race.

BRIEFING	TAKE-OFF	E.T.A.	DETAIL
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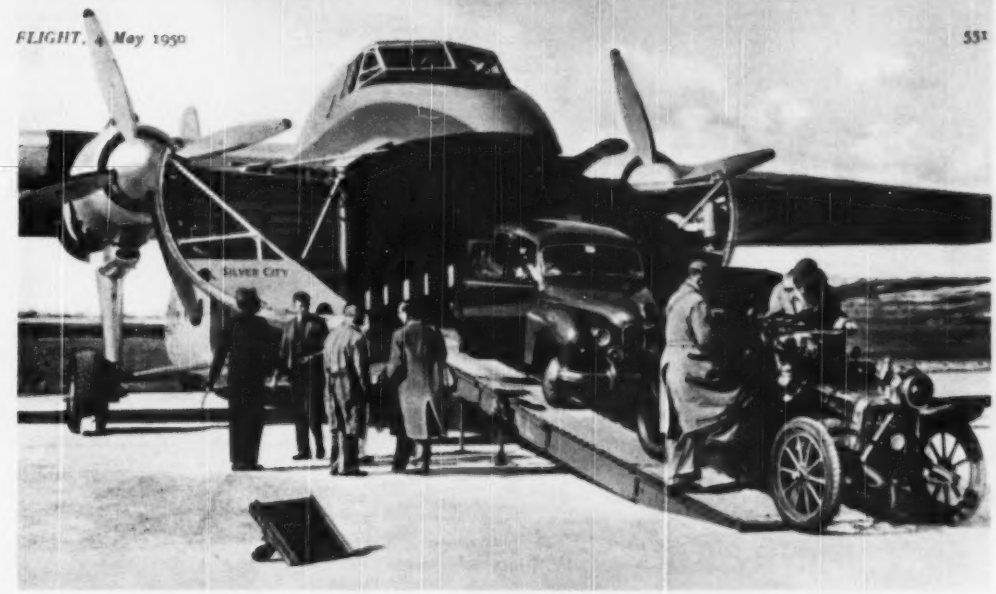


(Above) Unloading the 1904 Darracq at Le Touquet. (Left) A Freighter is collected at Filton : Mr. R. Ellison and Mr. C. S. Cowles (Bristol assistant chief test pilot and assistant sales manager) with A. Cdre. G. Powell and Capt. C. I. Hopkins (Silver City managing director and chief car-ferry pilot).

CARS GO AS CARGO

—and Their Owners Go Too : The Silver City Air Ferry

THERE are several accepted methods of crossing from the English to the French coast—by ordinary airliner, rail-ferry, mail steamer or even by swimming—but quite the most pleasurable and certainly the speediest way is to make the 20-minute flight from Lympne to Le Touquet, on which one may travel complete with car, family and as much luggage as one is likely to need on a Continental tour. The car ferry operated by Silver City Airways, Ltd., has now been running for two years, and on April 1st the company officially started a further two-year operating period under an associate agreement with B.E.A.

Although essentially a seasonal affair, the service was in great demand until late last year, and the company hopes that this summer at least six aircraft will be engaged on as many as 24 flights daily. After a thorough overhaul during the winter, three Bristol Freighters emerged, as new, from the manufacturer's base at Filton on March 29th, and were duly flown to Silver City's base at Blackbushe before commencing operations on the Lympne-Le Touquet run three days later.

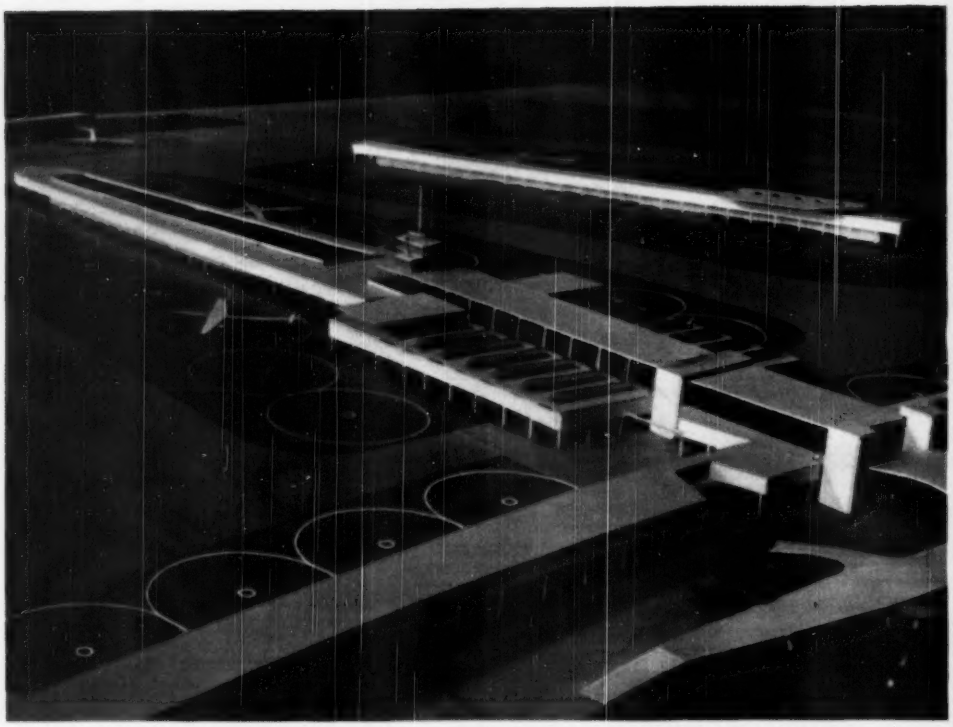
Widely varied types of car have been ferried during the past two seasons, but none so odd as the 1904-vintage Darracq that was shipped alongside a 1950 Austin A70 on April 14th, while a 1950 Alvis, en route to the Amsterdam Motor Show, was carried by another Freighter that flew alongside. On this particular trip, made by way of a demonstration, *Flight* was able to sample the facilities.

Quite obviously, and in spite of the fact that the motoring organizations have done much to simplify the carriage of cars by sea, the air method presents a particularly trouble-free means of taking a vehicle across the Channel: loading and unloading are quickly accomplished, so that the long waits often suffered at ports are avoided. Passengers in the Freighters travel in an 11-seat cabin aft.

Fares are on an inclusive basis, £27 (single journey) being charged for a car of up to 14ft overall length, with four passengers and luggage, while for vehicles of greater length £32 is charged. Bookings can be made with Silver City Airways at 11 Great Cumberland Place, London, W.1 (Paddington 7040), or through travel agencies. The sponsors of the Autocheque system, incidentally, offer their facilities in connection with the service.

There and back : The vans in which the Silver City personnel drove down to Filton were flown back to Blackbushe in the Freighters.

Thinking Ahead



Details of the proposed construction of the main building may be seen in this close-up of the designer's model.

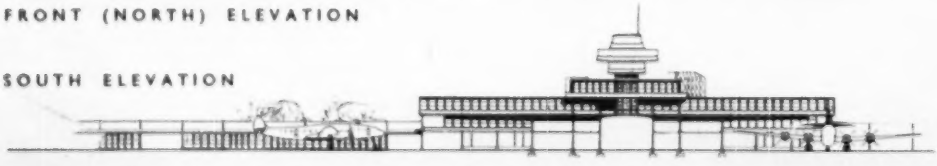
Pleasing and Practical : a Design Study for London Airport's Terminal Area : Separation of Passenger and Freight Traffic : Use of Underground "Railway" System

WHETHER he be a Stratocruiser passenger giving a questing glance as his aircraft gathers speed for the take-off, or the onlooker in the public enclosure gazing wonderingly at the busy scene, there can surely be few among the visitors to London Airport who do not indulge in conjecture as to the shape and form of the future terminal building in the airport's central area.

Some may even have contemplated the magnitude of the task of planning and designing such a building, complicated as it is by the myriad requirements of passenger handling, aircraft servicing and traffic control and governed, above all, by the "god of speed." For speed, or rather the reduction of delay in such operations as aircraft turn-round, freight and baggage-loading and Customs and Immigration control clearance, is undoubtedly the largest single factor in determining layout.

So far as London Airport is concerned, the M.C.A. has not, as yet, announced any definite plan for the existing

FRONT (NORTH) ELEVATION



SOUTH ELEVATION

WEST ELEVATION

Central Area which is to contain the terminal itself. A great deal of research has been carried out, however, in an attempt to enumerate the many requirements for such a building; a summary of these investigations was given in *Flight* of January 12th.

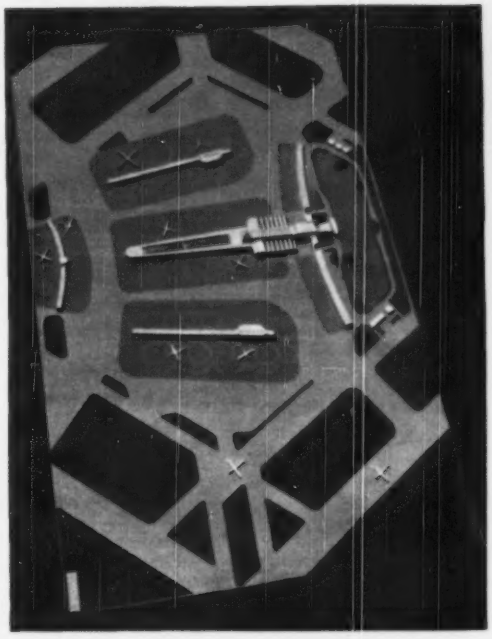
The impressive designs depicted on this page are rather more than an artist's conception of what the terminal buildings may eventually look like. The work of a Polish student of architecture, Mr. W. O. Biernacki, they represent a two-year study of the traffic and allied problems envisaged for London Airport when the plan for concentrating all the regular London services is realized in 1954-55.

Using as a basis for his study an assumed capacity for handling up to 100 aircraft movements per hour, the designer has evolved what appears to be both a rational and an attractive solution to the architectural problem while at the same time providing an efficient arrangement for the speedy handling of aircraft, passengers and freight. Complete separation of the two kinds of payload is envisaged. All passenger-handling and loading would be carried out on an upper level by means of telescopic loading-bridges, while the whole of the ground floor is left free for vehicular traffic and freight-handling.

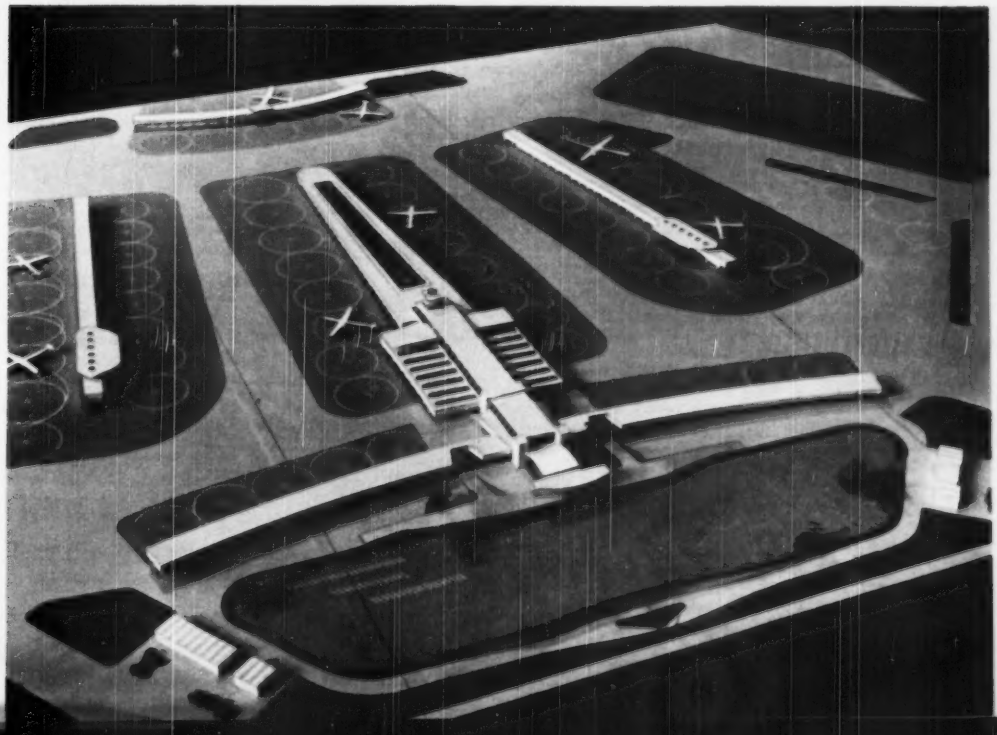
A circulating system of electrically driven trolleys would carry freight and baggage to the outer concourses, while passengers emplaning from these positions would reach them by a similar method of transport. Passengers on internal services would embark from the two wings adjacent to the main building, as entry to these positions does not entail passing through the Customs hall.

The thesis from which this material is abstracted comprises many detailed scale drawings of this distinctive layout; among them there may well be some pertinent and valuable pointers for those who are at present planning London's air terminus.

E. A. G. R.



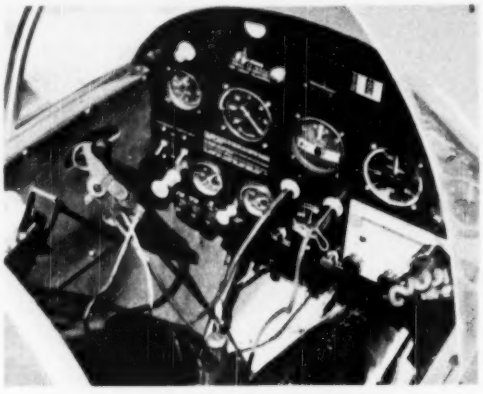
The layout of the central area is seen in the near-plan view (right, above); a maximum of 83 loading positions can be provided. Access to the imposing main entrance (visible in the panorama below) is gained by a tunnel, which is, in fact, now under construction.



LIGHTWEIGHT TRIO

Three Approaches to Varied Requirements of the American Private Owner : Small and Sporting : Safe and Slow-flying : Strong and Simple

MOONEY M-18L



LIVELY performance and economy of operation characterize this neat single-seater—designed mainly for the sporting pilot. Its engine is a 65 h.p. Lycoming four-cylinder air-cooled unit, driving a fixed-pitch wooden airscrew, and giving a maximum speed of 138 m.p.h. Cruising at 115 m.p.h., the M-18L's fuel consumption is 3.5 gal/hr, and its range is 390 miles. The Mooney "Simplifly" flap operation, incorporated in the otherwise conventional control system, automatically sets correct tail-trim for take-off, climb, approach and landing. With flaps down, the M-18L lands at 40 m.p.h.

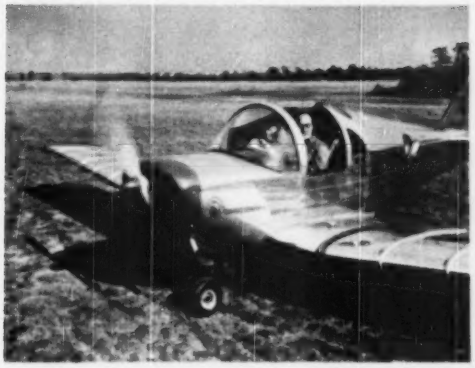
Construction is mixed. The wings, of 26ft 10in span, are all-wood and fabric-covered, with plywood leading edge. The forward section of the 17ft 7in fuselage is of steel tube, metal-covered; fabric covering is employed for the monocoque plywood rear section. Retraction of the steerable nosewheel undercarriage is effected by manual cockpit control.

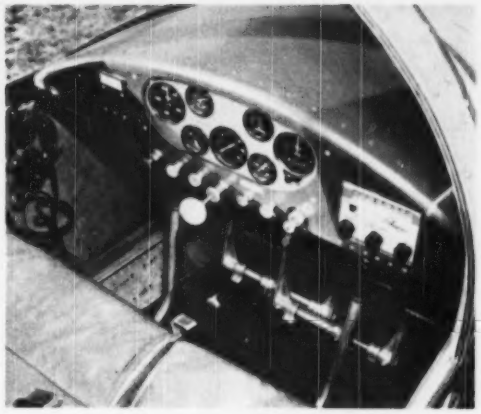
LANIER PARAPLANE

UNLIKE the accompanying Mooney M-18 and Emigh Trojan, which are on the American market at approximate prices of, respectively, £800 and £1,200, the Paraplane is at present experimental; no definite production date is foreseen. Members of the Lanier family have been building prototypes on the Paraplane principle since 1928, with a vacuum-chamber wing for high lift at low speeds.

In their latest model, which is powered by a 90 h.p. Continental engine, are six sets of vanes, in both upper and lower wing surfaces, which are opened for take-off and landing. Air is thereby directed from beneath the wing into a venturi passage inside it, and passes over the top surface to maintain abnormally high lift at low speeds. For cruising the vanes are retracted, and flow over a normal aerofoil keeps the Paraplane airborne. The speed range is from 120 m.p.h. to 30 m.p.h.; although, it is claimed, no one has been able to stall this unorthodox lightweight.

EMIGH TROJAN A2





WITH an eye on economy and strength, the Trojan's designer has employed simple, although partly unconventional, all-metal construction. Not only the wings but also the tail components are interchangeable. Otherwise, the general formula of the Trojan follows straightforward practice. The aircraft has side-by-side seating for two and room for a child in the luggage compartment. The nose-wheel undercarriage is fixed. Handling characteristics are reported to be unaffected by the external wing ribs.

The 90 h.p. Continental engine drives a fixed-pitch metal airscrew. Top speed of the Trojan is quoted as 126 m.p.h.; cruising and landing speeds are, respectively, 115 m.p.h. and 48 m.p.h. Twenty-eight gallons of fuel are carried in centre-section tanks, giving a range of 600 miles. With its generous one-piece windscreen and large semi-circular canopy, the Trojan cockpit offers excellent visibility.

FOR THE AERONAUTICAL BOOKSHELF

"Airplane Performance, Stability, and Control," by Courtland D. Perkins and Robert E. Hage. Chapman and Hall, 37, Essex Street, London, W.C.2. Price 56s.

AS may be gathered from the spelling in the title, this book is of American origin; Professor Courtland D. Perkins holds the Chair of the Aeronautical Engineering Department of Princeton University, and his co-author, Robert E. Hage, is Senior Engineer of the Preliminary Design Department, Boeing Airplane Co. The authors give it as their purpose to present those elements of applied aerodynamics that bear directly on the problem of aircraft design, and state that the book has been written to meet the needs of the practising aeronautical engineer as well as to cater for the requirements of class instruction.

The subject-matter is divided into two sections, in the first of which is presented the classical methods of estimating aircraft performance, and substantiation by modern aircraft data is given within the limitations of security. Performance in the subsonic, transonic and supersonic speed ranges is discussed, as well as the effects on aircraft performance of various types of reaction power-plants. In the second part of the book, attention is paid to what the authors state to be the comparatively new art of designing the aircraft for adequate flying qualities.

"National Air-Race Sketchbook," by Buehl and Gann. Published by Floyd Clymer, 1268, S. Alvarado St., Los Angeles, California. Price $2.00.

THE authors of this history of America's National Air Races, from 1929 up to the present day, are to be congratulated on getting together drawings of the most amazing series of winged wonders ever packed into one book. There are "sawn-off" Corsairs and Airacobras, Mustangs minus their familiar belly-radiator, and dozens of enormous engines with tiny airframes tacked on behind, and graced with names like *Chief Oshkosh, Goon* and *Eightball*.

The result is a book of undoubted value to the collector and model-maker, as it contains also the results of every race in tabulated form, notes on the more outstanding performances and more than a dozen large three-view drawings of such famous racing aircraft as the Gee-Bee and Cook Cleland's modified Corsair. For any youngster with a favourite aunt in the States, this is about the finest value in aviation books obtainable for her money!

BOOKS RECEIVED

The Science of Flight, by O. G. Sutton. Pelican series (Penguin Books, Ltd., West Drayton, Middlesex). Price 1s 6d.

America Latina: Un Pais. Libreria Y Editorial Perlado, Rivadavia 1731, Buenos Aires. Price $12.

Mecanique de l'Aviation; Propulsion et Performances, by Pierre de Valroger. Librairie-Imprimerie Gauthier-Villars, 55, Quai des Grands-Augustins, Paris, 6e. Price 2,500 fr.

Rapid Navigation Tables, by W. Myerscough and W. Hamilton. Sir Isaac Pitman and Sons, Ltd., Parker Street, London, W.C.2. Price 17s 6d.

The Aeroplane Directory, 1950 Edition. Temple Press, Ltd., Bowling Green Lane, London, W.C.1. Price 7s 6d.

Physics, by C. L. Boltz. George G. Harrap and Co., Ltd., 182, High Holborn, London, W.C.1. Price 10s 6d.

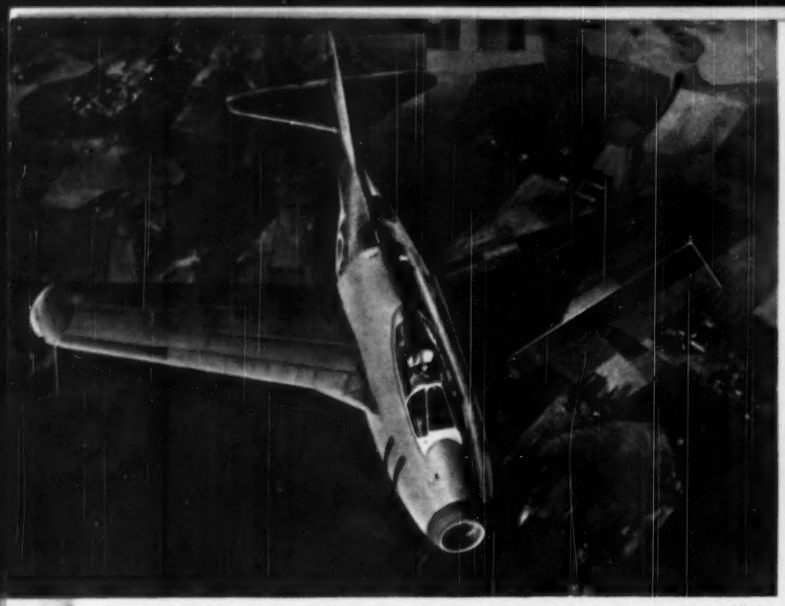
Aerials for Centimetre Wave-lengths, by D. W. Fry and F. K. Goward. Cambridge University Press, 200, Euston Road, London, N.W.1. Price 18s.

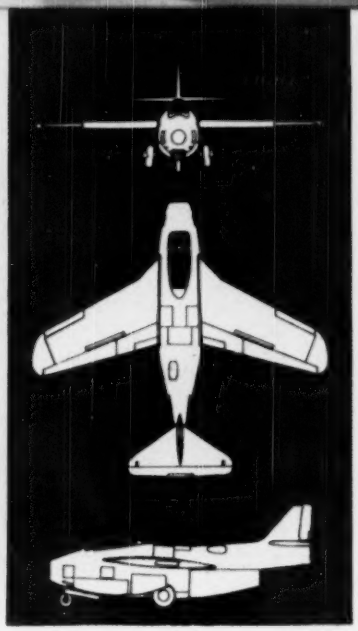
Aircraft Maintenance and Service, by Col. R. H. Drake. Macmillan and Co., Ltd., St. Martin's Street, London, W.C.2. Price 42s.

The Complete Air Navigator, by D. C. T. Bennett. Sir Isaac Pitman and Sons, Ltd., Pitman House, Parker Street, London, W.C.2. Price 25s.

The Theory and Design of Gas Turbines and Jet Engines, by E. T. Vincent. McGraw-Hill Publishing Co., Ltd., Aldwych House, London, W.C.2. Price 64s.

Between Earth and Sky, by August Piccard. The Falcon Press, Ltd., Crown Passage, Pall Mall, London, S.W.1. Price 15s.





A recent air-to-air study of a Saab-29 prototype, showing the mainplane, with its 25-deg sweepback, to special advantage. The view is also indicative of the pilot's range of vision.

SAAB-29

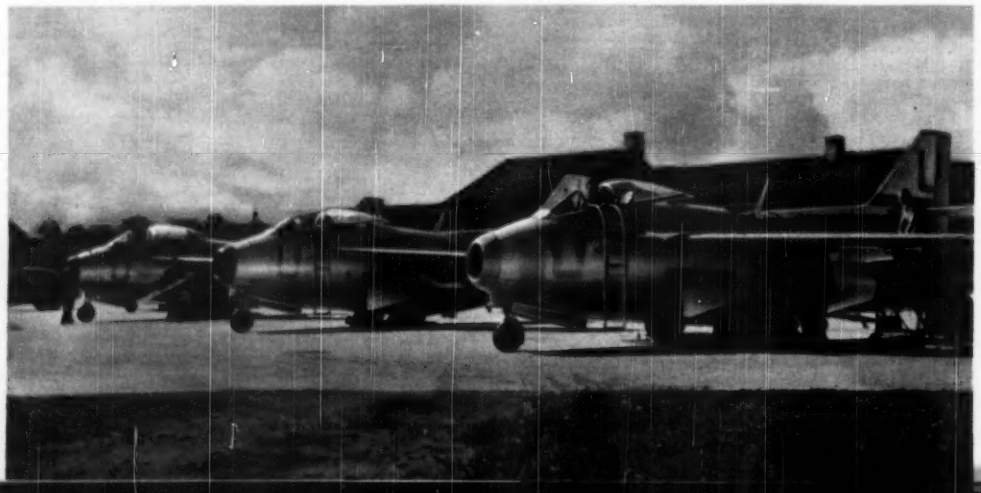
Sweden's New Jet Fighter : Mach Number Above 0.86 : de Havilland Ghost Turbojet

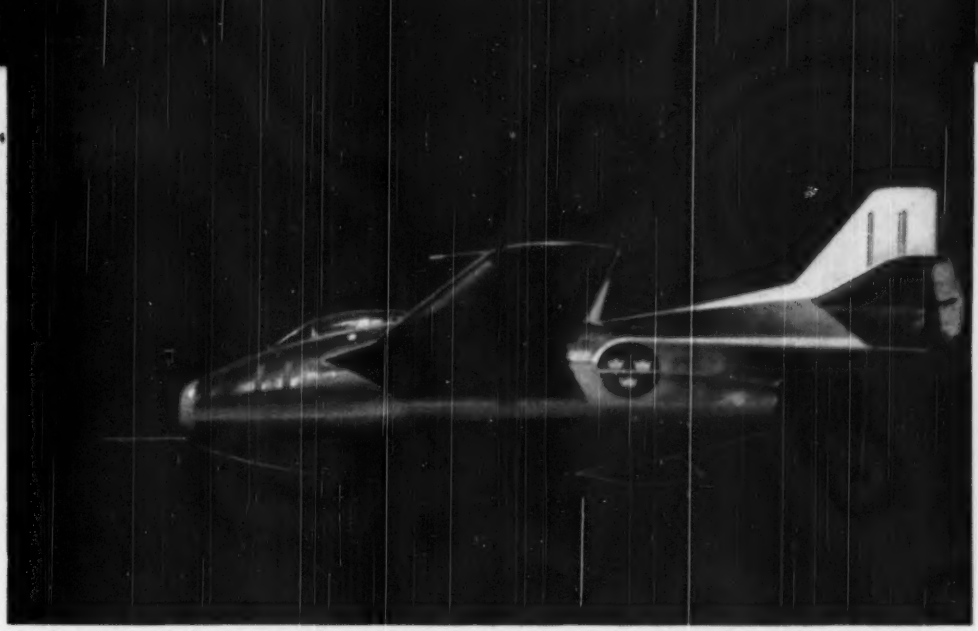
RANKING high among the world's jet fighters in speed and all-round efficiency is the Saab-29, now in quantity production for the Swedish Air Force. A contract for 500 machines, bearing the official designation J-29, has been announced. Though the type is the first Swedish aircraft to have been designed specifically for jet propulsion, the constructors have amassed valuable experience with the twin-boom Saab-21R, a simple, and remarkably successful, adaptation of the piston-engined Saab-21A. The 21R is already well established in squadron service, and the Editor's flying impressions of the type appeared in *Flight* of June 24th, 1948.

The original scheme was drawn up late in October, 1945. After wind-tunnel tests at the Aeronautical Research Institute, Stockholm, a straight-through airflow system was adopted to obviate development delays and ensure maximum attainable thrust at high speed. At first the de Havilland Goblin turbojet, of 3,100 lb static thrust, was visualized as the power unit. The pilot being seated astride the duct, the fuselage was necessarily very deep and, since the thinnest possible wing section was desired, it became necessary to retract the main undercarriage into the fuselage sides. These considerations jointly determined the characteristic "barrel" configuration. Extension of the tail surfaces beyond the "barrel" was necessary for reasons of stability, and to enable the full landing angle to be achieved with a short undercarriage. Though the Saab technical staff readily admitted "certain æsthetic imperfections," their design aroused the interest of the Swedish Air Force and design work went ahead.

By Christmas, 1945, information had become available concerning the de Havilland Ghost turbojet, estimated to produce 5,000 lb thrust. With its diameter of 4.5ft and provision for a central circular air intake, it proved admirably suitable. Another important acquisition was German information on high-speed flight and swept-back wings. More expeditiously than the Western Allies, the bilingual Swedish engineers were able to put this data to good account in their design deliberations. A 25-deg sweep was selected. Calculations were made to determine how

The three Saab-29 prototypes paraded together. One is a "flying laboratory" and a second has installations for armament tests.





The fuselage lines and tail configuration of the Saab-29 are brought out in this view from beneath. The jet orifice is also apparent.

slender the fuselage would have to be in order that its critical Mach Number should be compatible with that of the wings, and though substantial bulk was found to be acceptable, the lines had to be somewhat more slender than was projected in the first instance.

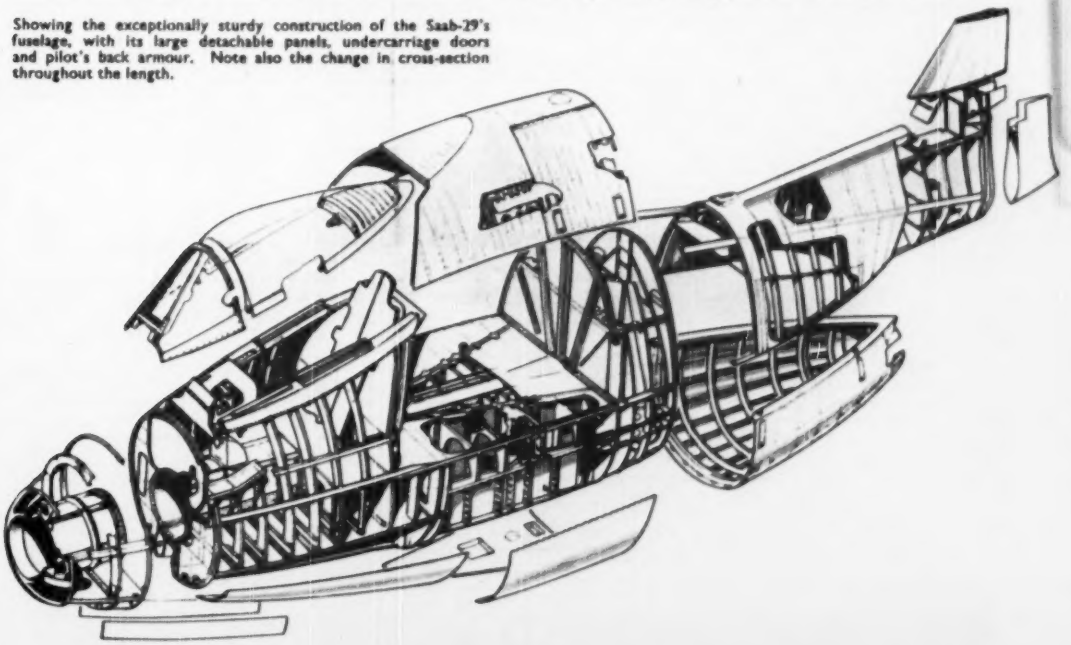
Wind-tunnel tests at the Swedish Royal University of Technology and the Aeronautical Research Institute disclosed the great advantages in stability and trim, within the wide speed range, accruing from an adjustable tailplane (a feature likely to be standardized on transonic aircraft of the immediate future), while selection of a thicker profile at the wing tips than at the root resulted in satisfactory stalling properties without appreciable deterioration in speed.

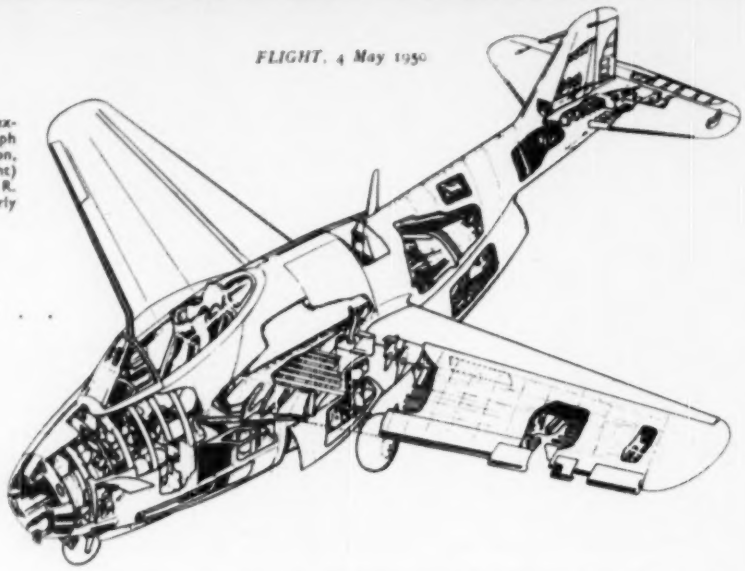
For the attainment of lateral stability at take-off and landing, automatic slots were deemed necessary. These were interconnected with the flaps, but automatically locked in the retracted position when flaps themselves were retracted. As a check on wind-tunnel tests it was decided to build a wing to approximately half scale for fitting to a Saab Safir, which received the designation "Aircraft 201." Flight tests promoted a strong feeling of security before the first trials of the fighter were made.

As is well known, various problems of strength arise in swept-back wings, and, to control the distribution of stresses in the structure, an entirely new method of calculation, development of which is still in progress, was devised. In the first instance a small model of solid rubber was constructed, the deformation of which, under load, could conveniently be studied in principle. Then followed a somewhat larger structure of light sheet metal in which the stresses were measured by strain gauges; a series of test panels and other elements; and, finally, a test on a full-scale wing.

To save weight in the heavily loaded, but thin, wing, the possibility was investigated of employing a material superior to duralumin. The Saab technicians were aware of the improved 75S alloy produced in the U.S.A. but were

Showing the exceptionally sturdy construction of the Saab-29's fuselage, with its large detachable panels, undercarriage doors and pilot's back armour. Note also the change in cross-section throughout the length.





(Right) The Saab-29 partially "exploded." Below, a *Flight* photograph of the Swedish Air Attache in London, Lt.-Col. N.-M. von Arbin (right) discusses the new fighter with S/L. R. Moore, who made all the early test flights.

SAAB-29 . .

uncertain whether delivery of such material could be made in time to meet their needs. The Svenska Metallverken, of Finspong, now came into the picture with a most valuable contribution—sheet metal and sections equivalent in strength to the original American product. But although this excellent material has been used in the most heavily loaded parts of the wing, the sheeting and extruded sections are of appreciably larger dimensions than hitherto customary.

The mock-up was more thorough than most—even to the point of having a realistic landscape, with lakes and clouds, placed ahead of the windscreen! It confirmed that the fuselage would have to be a somewhat complicated structure—a mixture of stressed skin and heavy frames—in order to fulfil requirements with regard to space, strength, rigidity and accessibility.

The first experimental pressure cabin is reported to have "leaked like a sieve" on being initially tested. Another problem was the servo control for the ailerons. In this connection the Saab engineers were somewhat uneasy as to how spring tabs would behave at the highest speed, since compression shocks across the wing were liable to occur sooner or later. A hydraulic system was eventually adopted. The four-gun armament installation was tested in a special mock-up from which thousands of rounds were fired over Lake Vättern.

By the end of August, 1948, the first of the three prototypes was ready for taxying tests, and on September 1st S/L. Robert Moore, D.F.C. and bar, made the first official flight—of half-an-hour's duration—and subsequently amassed some 100 hours. The Swedish pilot now continuing the flight tests is Ing. Bengt Olow.

Complete details of the Saab-29 are not released, but it can be said that the fuselage is built in three sections and that the central air duct is integral and stress-bearing. Cabin pressurization is by Marshall blower and the ejector seat is of Saab design, with three powder charges. It may be noted that the first Saab ejector seat was designed as long ago as 1942-43, and is standard equipment in the 21A and 21R fighters. Explosive jettisoning is also used for the canopy.

The two-spar wing is a single-piece structure, attached to the fuselage by four bolts, and the automatic leading-edge slots are light-alloy castings. Two different aileron systems have been tested: (1) combined aileron and full-span flap, and (2) a conventional aileron/flap system. The first makes possible an extraordinarily high rate of roll at high speed (approximately 220 deg/sec) while (2) gives a more normal rate of about 120 deg/sec. Both systems employ hydraulic boost. Air brakes are normally fitted to the wing aft of the rear spar, but fuselage brakes have also been tested.

Tailplane incidence is varied electrically between the angles of +1 deg and −6 deg. The operating switch is on the pilot's control column and two different setting speeds are available, the lower being for high-speed trim, giving a change in setting of approximately 1 deg/sec. As a precaution the elevator has a mechanically operated trim-tab. Geared tabs are fitted to both the rudder and elevator.

The undercarriage is designed for operation from grass fields and is hydraulically retractable; the brakes are single-disc Goodyears.

The Ghost turbojet is supported at three points on a strong fuselage frame, and the engine cowling—stressed for tail loads—is removable in one piece. The power plant is installed, with the aid of a special trolley, from below. Although the prototypes are powered with Ghosts of 4,400 lb thrust, production aircraft will have fully rated (5,000 lb) units.

Concerning performance it can only be said that the Saab-29 is designed for a maximum speed of over 650 m.p.h. (Mach Number 0.86), and that the design Mach Number has been exceeded with the aircraft under full control.

The span is 36ft 10in; wing area, 258 sq ft; and aspect ratio, 5.04.

From the foregoing it will be judged that Sweden's need for a robust fighter of higher performance than the Vampires and Saab-21Rs, which are rendering such exemplary service, will be amply met when the time for re-equipment arrives. Though no information as to range and endurance has been made available, it is evident that there is space in the Saab-29's fuselage for an impressive tankage, and it should be possible, furthermore, to carry auxiliary tanks beneath the wings.

The northerly terrain of Sweden being little more than a rugged wilderness, snow-covered for much of the year and studded with lakes, a safe forced landing would rarely be possible, and it was with this in mind that the Saab ejector seat was developed during the early war years. Another consideration was the difficulty of baling out of the Saab-21 series of fighters, due to the twin-boom design and high-set tailplane. On the Saab-29, of course, the seat is necessary in any case due to the high speed of the aircraft, so the Swedes are now being doubly rewarded for their enterprise.

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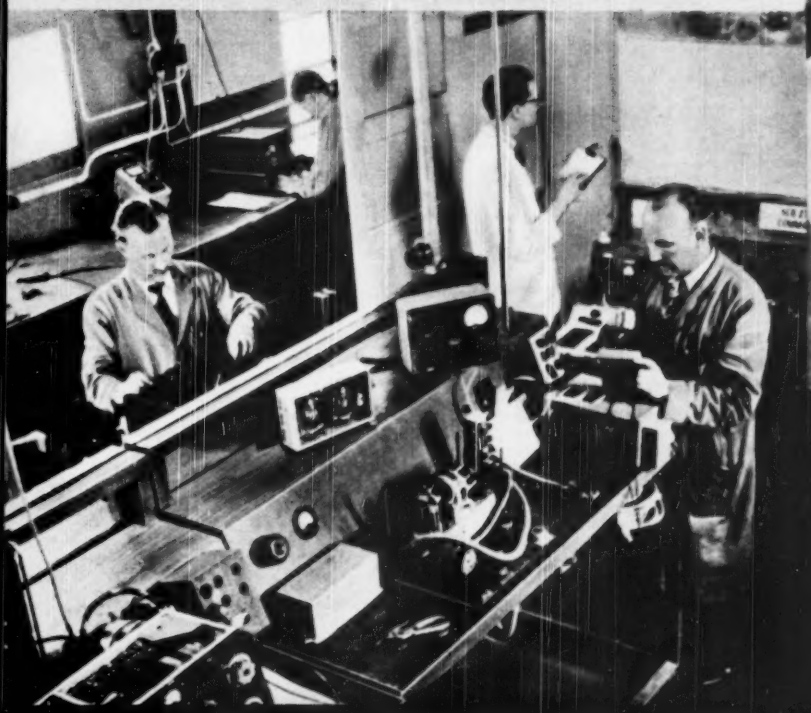

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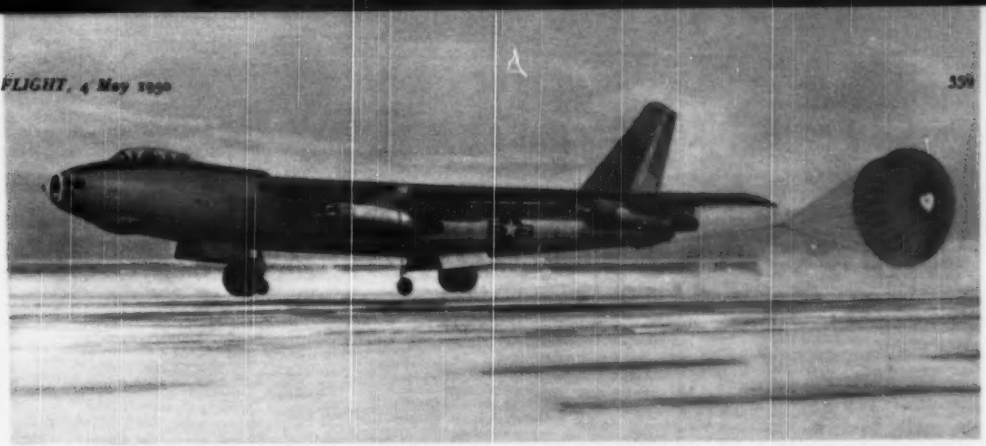

Tail umbrella: Boeing are investigating several methods of decelerating the landing run of their jet types, and the experiments have included the use of the tail parachute, here seen in action on the XB-47 bomber. Reverse-rocket motors may also be tried

AMERICAN NOTEBOOK

"Pennellizing" the Civil Jet : Some Trial-kite Flying by Boeing

By Stanley H. Evans, F.R.Ae.S., A.F.I.Ae.S.

FOLLOWING our recent discussion on jet-transport design *desiderata* (February 23rd) comes another sparkling volley from a top-ranking player in the Boeing design team. In the March issue of the *Boeing Magazine*, under the title of "Jet Airliner Design Problems," Mr. Maynard Pennell, Boeing's chief of Preliminary Design, outlines the principal design characteristics which a superior jet transport should possess—as seen through the Boeing looking-glass. Naturally enough, since a bird in the air is worth two on the board, the reflection has all the military airmarks of the B-47 Stratojet bomber.

Basically, says Mr. Pennell, the most important of several reasons for progressing from piston-engine to turbojet in commercial aircraft is *speed*. To Boeing engineers, however, the speed potential of the jet airliner is not just another reduction in travel time, but rather the opportunity to advance, in one big leap, to speeds that cannot be surpassed for a long time to come; in other words, it offers the ability to push right up to the foothills of the Mach mountain or transonic divide—which in the case of the standard 35-deg sweepback means in the region of M=0.90 or practically 600 m.p.h. above the 35,000ft level. Whether, however, this objective is the maximum or the cruising speed is not categorically defined. The distinction, as we see it, is important.

Mr. Pennell is cautious enough to point out that for commercial operation supersonic speeds remain considerably farther than just around the corner, since the problems associated therewith are beyond the power of currently available jet units—at least within reasonable economic limits; thus, for other than military or special purposes, it will probably be necessary to await the development of new sources of power or other unforeseen technical innovations. But in the meantime, says Pennell, Boeing are satisfied that they have opened the doorway to the upper limit in subsonic speeds by writing their civil jet prescription around the B-47 military formula—meaning, more specifically, the thin wing of high aspect-ratio and emphatic sweep. The evidence for this diagnosis is based upon the proved performance of the XB-47 during the past couple of years.

This jet-bomber experience—tempered with knowledge gained from designing conventional transports—has put on American drawing-boards to-day the most advanced turbojet transport designs in the world, says Pennell! Which is a bold (but wistful) claim, if we dare say so, for it amounts to the wishful thought that a bird on a blueprint whistles louder to the customer than the bird already "whittling" in the blue. This sales philosophy may have had some factual basis at the time the Stratocruiser was projected from its military antecedents (the B-29 and C-97), when world competition was less keen, but to-day the commercial situation is entirely different. Furthermore, the military attributes of an aircraft are no automatic recommendation for its fitness in the commercial sphere; in fact, post-war experience has proved quite the contrary.

Most of the design characteristics enumerated by Mr. Pennell in defence of the Boeing civil-jet proposals have already been discussed in these pages, so we need not go back over the same ground. The underlying motif—or perhaps one might more truly say the outstanding theme—is, of course, the thin, flexible, high-aspect-ratio wing and the peduncular poddery concomitant therewith. The external pod theme, according to Boeing thinking, is considered virtually a must for the jet transport as well as the military bomber, which seems to us rather a specious argument in view of the conjoint nature of the two features. The "must" in this postulate is that, like Siamese twins, they must stand or fall, live or die, together.

One difference freely acknowledged by Boeing engineers is that the wing loading of the jet transport will have to be lower than that permitted in the B-47. Just how much lower is not yet divulged, although further data are promised in a second article by Pennell. Currently, we believe the B-47 is taking off at around 110 lb/sq ft, a loading which is likely to climb still higher as take-off and landing techniques are perfected with a view to pushing up the range performance. On the evidence of the Stratocruiser's wing loading of a shade over 80, it seems a fair guess that that of the Boeing civil jet will not fall much below, say, 90. Comparing this with the modest 52 of the Comet shows how deeply the military-missile influence has penetrated into American commercial planning. And nothing shows more penetratingly how wide is the gulf that separates the design philosophies of Boeing and de Havilland. (On stalling speed, for instance, the difference amounts to roughly 30 m.p.h. in favour of the Comet—and the passengers' health!)

Under present C.A.A. regulations, commercial aircraft must demonstrate their ability to land over a 50ft obstacle

AMERICAN NOTEBOOK . . .

and come to a complete stop within 60 per cent of the runway length for which they have been certificated. The jet bomber, on the other hand, does not have to meet this 40 per cent safety margin, while at the same time it is normally operated out of larger airfields; then, again, the bomber does not have to land with more than a fraction of its take-off load, especially so in the case of the B-47, wherein the fuel and bomb load constitute a large proportion of the gross weight. This means, of course, that the B-47's take-off is more critical than its landing condition—a point which is tacitly confirmed by the high-powered Jato boost installation built in to the fuselage sides. The contrary conditions exist, for the transport and Boeing designers believe that the landing distance will be the determining factor.

In general, the Boeing studies have shown that once a satisfactory wing loading has been established and adequate power made available for cruising, these same engines will enable the aircraft to take off well within the limitations of fields acceptable from a landing standpoint. It is admitted that an exception to this finding might be presented in the case of take-offs from high-altitude fields, especially on hot days. Such a condition may dictate the necessity for taking off at reduced gross weights or the provision of thrust augmentation in the form of water injection, afterburning, or rocket boost.

To provide additional margins of safety during landing, several methods of auxiliary deceleration, equivalent to that furnished by reverse-pitch airscrews, are under study by Boeing. These possibilities include the development of one or more of the following decelerative techniques: reverse-rocket motors, drogue parachute, more efficient braking or anti-skid devices, drag-creating spoilers, or a wing-flap design providing increased lift and reduced stalling speed. Improved high-lift (and high-drag) slats and flaps would seem to be mandatory with wing loadings approaching the century mark. Although improved high-lift devices are now, perhaps, overdue in commercial-design, it is worth noting that the Comet is enabled to escape a good deal of this extra mechanical complexity by virtue of its relatively low wing-loading; and, for the same reason, we imagine it is unlikely to sprout a tail umbrella.

Trial Kites

As if to try out these ideas on the aeronautical world, Boeing recently released three more design-study sketches, all unmistakably painted with the military brush that created the B-47. (The sketches were published in *Flight* of April 13th, but are repeated here as a refresher.) The first study in this astral canvas depicts a long-range, trans-oceanic airliner equipped with six turbojets mounted in the gondola fashion of the Stratojet. An odd difference, however, is noticeable in the civil version—the mounting of the duplex pods has been transferred to the outboard wing stations. This version also inherits the waisted double-deck fuselage configuration of the Stratocruiser. The other two design proposals are both powered with four turbojets mounted in duplex power-pods located extremely far outboard on the wing. In addition, the third design carries externally mounted wing fuel tanks at the inboard station—as, in fact, in the scheme previously illustrated on page 252 of the February 23rd issue of *Flight*.

Since we suspect these latest proposals are trial kites sent up to spark the lightning, we feel sure our Boeing friends won't mind us adding a mild roll or two of thunder to liven up the astral performance. The most startling feature is the displacement of the thrust axes far outboard from the axis of symmetry of the aircraft. Apparently the aero-elastic *desiderata* of the thin, backswept wing must override all normal aerodynamic design criteria, for it looks as if the jet pods have been primarily treated as anti-flutter balance weights, with their function as power units relegated almost to playing a secondary role. This, for what it may be worth, is our own interpretation of such aerodynamic heterodoxy.

Just whether the C.A.A. (with especial emphasis on the "C" for civil) could ever be persuaded to sanction such asymmetry under partial-power-failure conditions at take-off is open to question. In any event, one imagines the airline pilots' professional guild or union would apply their own sanctions in the form of a flat-out boycott, for it is a well-established statistical fact that far too many lives have been lost or endangered through asymmetric power failure. To our desk, as we write, comes notice of a C.A.B. report of a crash landing of an American Airlines Convair-Liner at Memphis, Tenn., last June—the accident analysis showing a power failure of the starboard engine at take-off. Fortunately, in the subsequent crash-landing, the pilot's skill saved the three crew members and 41 passengers the usual incineration. With this sort of thing in the news, it is strange that Boeing engineers have gone so far out of their way to cancel one of the brightest features of the turbojet—namely, the chance of close centre-line grouping as seen in the Comet.

The unwelcome asymmetric possibility suggested by the Boeing scheme has brought forth a critical note from a reader. Indeed, Mr. A. A. Jarvis (Correspondence, March 9th) takes us mildly to task for not making more of an issue of it in our earlier discussion on the pros and cons of external power-pods. Truth to tell, we purposely soft-pedalled this particular issue because we have consistently stressed it in the past. Actually, though, we implied it by remarking (page 254, February 23rd): "Aerodynamically, there can be little doubt that the Comet is the more logical and cleaner solution. . . ." Perhaps we should have expanded the "logical" term in the equation, but we can assure Mr. Jarvis that in *our* book a logical civil-design formula would certainly include partial-power thrust symmetry as a must.

Here again, then, we sense the wide chasm that divides the opposing schools, military and civil. The chasm, in fact, is almost as wide as the wing span, for the Boeing power-pod concept seems designed to start at or near the tips, working inboard, whereas the de Havilland designer has obviously worked as close to the fuselage as possible, the root chord being matched to suit the power-plant in a natural manner. It is worth remarking that the spanwise spread of the B-47's outboard engines is just four times that of the Comet's, although the wing spans are practically the same.

Eventually, as the dimensional scale approaches its structural and economic optimum, we may expect to see a fully submerged central power-plant comprising a battery of turbo-ram-jet units mounted close together practically on the centre-line of the aircraft, thereby facilitating the closing down of certain units under cruise-control conditions at high altitude. In this respect, we believe the aircraft designer will follow in the footsteps of his elder brother, the naval architect. Ten years from now—on the civil side at any rate—the outboard "clothes-pegging" of power pods along the wing boom will look as illogical (and as grotesque) as would outboard motors fitted to the *Queen Elizabeth*.

B-47 derivative: The three civil-jet design-studies prepared by Boeing. They are critically analysed above by Stanley H. Evans.

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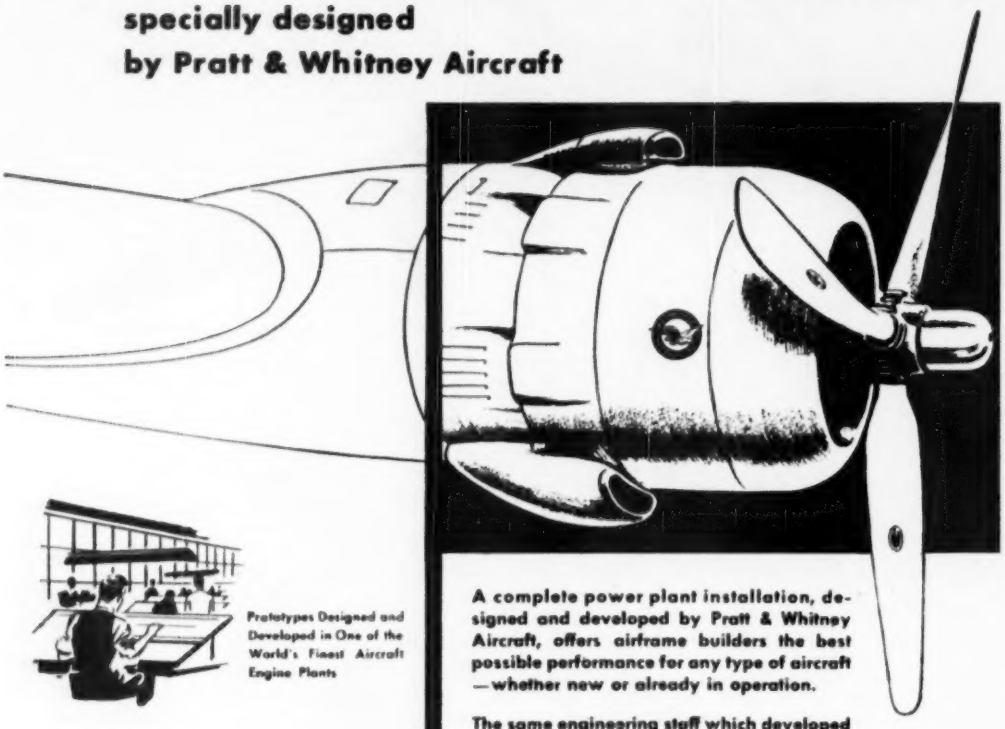

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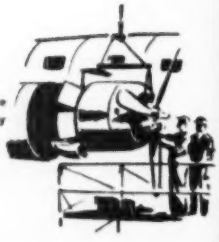

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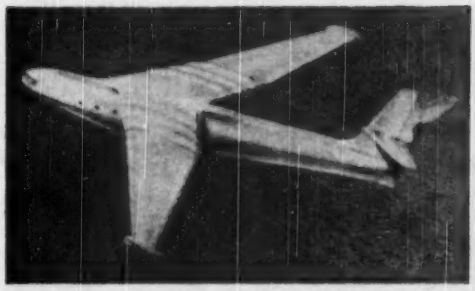
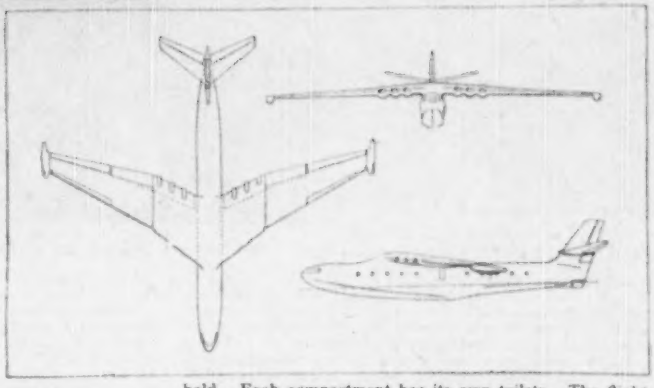


ENTER THE DUCHESS

First News of 500-m.p.h., Six-Ghost Saro, Designed for Economical Operation

For years past, flying-boat protagonists have awaited just such a craft as the elegant Duchess which, though bearing a family resemblance to the turbo-prop-powered Princess, is of totally new, and thoroughly uninhibited, design.



A VERY beautiful jet-propelled, medium-range flying-boat, to be known as the Duchess, has been designed by Saunders-Roe, Ltd., and is being considered by Tasman Empire Airways for journeys such as that between Australia and New Zealand. The designed gross weight is 130,000 lb and the span 124ft 6in. Salient features of this unusually interesting and thoroughly British craft, in which the most advanced aerodynamic and hydrodynamic techniques are manifest, are depicted here.

Installed in a similar manner to that of the Comet, the power plant will comprise six D.H. Ghost turbojets, for which a static thrust of 5,000 lb each has been presumed. The high length/beam ratio, full-length planing bottom, faired step and large water rudder are shown in the general-arrangement drawing, as is the unusual method of mounting the wing above the hull. Lateral stabilizing floats retract to lie on the wing tips in the same manner as those of the Princess.

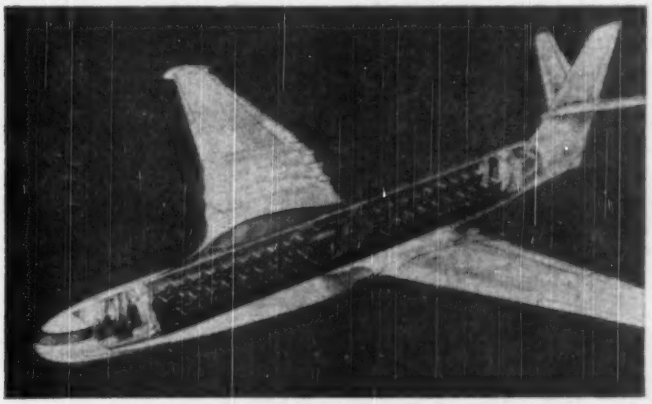
The interior layout illustrated for the pressurized and air-conditioned cabin is only one of many which could be arranged to suit an intending operator; the particular arrangement depicted allows for 74 passengers in two compartments connected by a gangway passing the freight-hold. Each compartment has its own toilets. The flight crew of four is carried in the nose of the hull which, in the interests of aerodynamic efficiency, is finer than is usual on a flying-boat. It thus becomes necessary for mooring operations to be performed from a compartment on the starboard side, aft of the two pilots' seats, though these could easily be arranged on the port side if desired. The freight and baggage hold is over the centre of gravity and has a volume of some 600 cu ft—sufficient for 66 lb of baggage for each passenger, and about 3,500 lb of freight. The maximum payload for a 1,300-mile stage is 21,000 lb.

Although the Duchess will be capable of cruising at 500 m.p.h., its most economical cruising speed will be 468 m.p.h. and its maximum level speed, 550 m.p.h. The unstick run, in a 10 m.p.h. wind at sea level will be only 1,200yds, and the climb to 30,000ft will be accomplished in 15 min.

It is claimed that, applying S.B.A.C. standard methods for assessing direct operating costs, the Duchess will be the most economical medium-range aircraft yet designed. The estimated cost per passenger mile is just over 1d for routes with a stage-length of 1,300-1,500 miles, and 2d on a stage distance of 2,000 miles. The cost per ton mile is quoted as just over 1s for 1,300-1,500 miles stage-length, and approximately 1s 6d for 2,000 miles.

Tank tests on model hulls are reported to have given very satisfactory results, and already Capt. Clarke, managing director of Saunders-Roe, is in New Zealand on business connected with the Duchess.

Although the Duchess appears to be an easier design to bring to fruition than the much larger Princess, with its ten Bristol Proteus turboprop units and twin-deck, "double-bubble" hull, some years must elapse before the type could be in service.



Showing a layout for 74 passengers, each with 66 lb of baggage. Together with about 3,500 lb of freight, the baggage is stowed in the hold amidships. Provision is made in the nose for a flight crew of four and for a cabin crew of two.

CIVIL AVIATION NEWS

THIS MODERN AGE: The United States was recently given a preview of the Avro-Canada Jetliner, when on April 18th, it flew from Toronto to New York in less than one hour. The aircraft, seen above against the familiar skyline of New York, took part in the Society of Automotive Engineers' aviation show.

THE JETLINER FIRST?

THE honour of being the first gas-turbine airliner to operate on a commercial route will, according to a recent announcement by Trans-Australia Airlines, go to the Avro Jetliner which, as a freighter, is to carry out operational utilization trials on the T.A.A. route network in October.

It was decided some time ago that flying conditions in Australia would provide an ideal testing ground for the Jetliner when it was completed. The aircraft is to fly to England for the S.B.A.C. Show, at Farnborough, in September, and it is scheduled to arrive in Australia the following month.

THE COMET'S TRIALS

FOLLOWING its record-breaking flight from London to Cairo on April 24th, and an afternoon devoted to flight trials at Farouk Airport, the D.H. Comet, on April 25th, flew to Nairobi, covering the 2,196 miles in approximately 5¼ hr.—not, as stated in an early report 6 hr 9 min. This represents an average speed of 418 m.p.h. The Comet thus travelled the 4,400 miles from London to Nairobi in a flying time of 10 hr 25 min, each leg of the flight being covered in about half the time taken by normal airliners today.

The Comet's flights to date have ably demonstrated its capabilities on long-range trade routes. B.O.A.C. expects to receive the first Comet of its fleet early next year, and, according to a recent statement made by Sir Miles Thomas, Comets will be introduced on the U.K.-Calcutta route by the end of the year. Ultimately the service will be extended to Sydney, which will be reached in something less than 40 hr or about half the time at present taken by the Corporation's Constellation service.

VISCOUNT SERVICEABILITY

SPEAKING at the S.A.E. National Aeronautic Meeting in New York, Mr. R. N. Dorey of the Rolls-Royce company, who has been closely associated with the development of the Dart, mentioned that the Viscount, which had just completed its first 400-hour inspection, had averaged one flying hour per day since its first flight—an extremely good record of serviceability for a prototype. The absence of pipe- and control-chafing, hinge wear and so on, normal on piston-engined aircraft, was a very noticeable feature. Serviceability of radio equipment and instruments had been outstanding during the whole of the flying to date, and the lack of engine and airscrew vibration was recognized as being responsible for this advance.

This information was given in the general concluding remarks to Mr. Dorey's lecture on "Extended Life of Propeller-Turbine Engines," the first part of which is reproduced almost in full on pages 542-545 of this issue.

Meanwhile, the Viscount's European sales tour was concluded on Friday, when it landed at Northolt from Amsterdam, having previously visited—on the second half of its tour—Copenhagen, Stockholm and Oslo.

WASHINGTON'S NEW AIRPORT

THE Friendship International Airport, at Baltimore, near Washington, one of the largest airfields in the world, will be opened for regular commercial traffic during the first week in July. It covers 3,300 acres, and one of the runways is 9,450 ft long. The airfield itself is five times larger than the National Airport, at Washington, and four times the size of La Guardia Airport, at New York. It has been built—on a site which is described as meteorologically perfect—at the comparatively low cost of $15,000,000 (approximately £5,350,000) and is designed to serve the Baltimore and Washington area for both national and international flights.

One of the principal features in the design is its capacity for expansion; the three existing runways can easily be increased to six in number, and accommodation provided for up to 24 operating companies.

MOSCOW TO KHABAROVSK

ALTHOUGH details of transport facilities within the Soviet Union are normally well-guarded secrets, Russia seems to be particularly anxious to publicize the fact that a number of new air services are being provided to link Moscow directly with South Sakhalin, Ufa, Osgorod, Guryev and Dnieproperovsk. Express flights to the east are being resumed with IL-12 airliners which, from May 1st, will leave Moscow every day for Khabarovsk.

Some idea of the extent of Soviet territory can be obtained by the fact that the journey from Moscow to Khabarovsk takes some 33 hr. Announcing these new services, the *Soviet News Bulletin*, published by the Russian Embassy in London, also claims that flights from Moscow to the various health resorts in Russia are now in great demand.

COMPETITORS TO CO-OPERATE?

IT is understood that K.L.M., Sabena and Swissair are investigating possibilities of what is termed a "Beneswiss" air agreement. The main object would be the pooling of fleets to meet keen American competition, and the plan would include the dovetailing of timetables, a joint representation and advertising campaign abroad and close co-operation in the matter of freight traffic. It has been stressed that the question is not one of amalgamating the three companies, but only of very close operational co-operation between them. If the present plans are successful, it is not unlikely that a similar arrangement would be adopted by S.A.S. and Air France.

I.F.A.L.P.A. CONFERENCE

THE fifth conference of the International Federation of Airline Pilots' Associations, attended by representatives of 17 relevant organizations, was held in Brussels from April 17th to 20th. It was attended, in addition, by delegates from I.C.A.O., I.A.T.A. and the International Transport Workers' Federation. A number of resolutions were adopted, and ratified,

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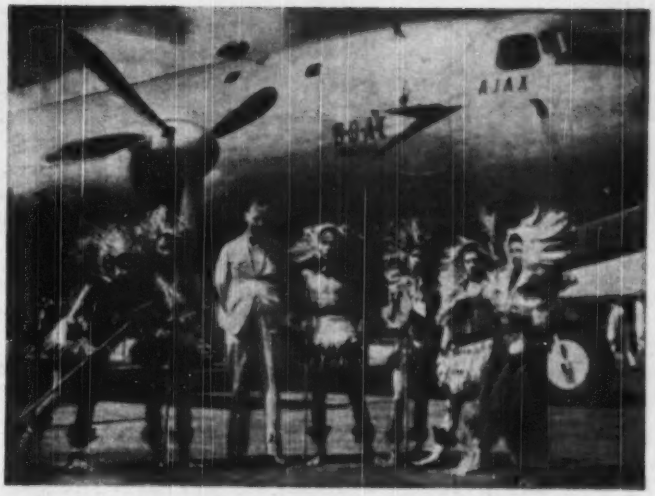
among them being several which referred to airworthiness and the performance of aircraft. The conference recommended that the automatic feathering device in its present state of development should not be accepted as a means of meeting climb requirements, and that the use of reversible aircrews, although welcome as an additional safety factor, should not be used in the same way to increase take-off and landing weight.

I.F.A.L.P.A. also recommended that I.C.A.O. should be asked to examine the problem of deterioration of aircraft performance with age. It was agreed that, pending the fitting in all aircraft of altimeters with sub-scales calibrated in millibars, traffic-control officers should only pass to the pilot a setting which had been obtained from the meteorological office after checking against sensitive altimeters in the control tower. The questions of the legal status of an aircraft commander and the civil liability of an aircraft captain were also given attention.

The conference was of the opinion that the increasing speeds of aircraft have caused a situation whereby the present limits of V.F.R. do not provide an adequate margin of safety. One of the most important decisions reached was contained in a resolution condemning the situation in which the uncontrolled or unrestricted flight of military aircraft is permitted within controlled civil airways.

Agreement was also reached on the requirements for crew complement, one point being that two qualified pilots must be carried on all multi-engined aircraft of more than 5,700 kg a.u.w. over routes longer than 500 n.m. non-stop. Although this was the minimum requirement, the conference felt that the presence of two pilots was desirable on all multi-engined aircraft. The Association recommended that I.C.A.O. should implement these requirements as soon as possible.

Amsterdam was chosen as the venue for the next annual conference, to be held in April, 1951.



FIERCE BUT FRIENDLY: Mr. J. W. Booth of B.O.A.C. is met by some "local colour" at Natal, Brazil, where the Argonaut *Ajax* landed during its recent trade flight to South America. As recorded last week, Mr. Booth has resigned from the deputy chairmanship, though he will continue to serve as a part-time member of the Board.

BREVITIES

SIR GEORGE CRIBBETT, the Deputy-Secretary of the M.C.A., arrived in Lisbon last week to discuss the Anglo-Portuguese air agreement of 1945. Before his departure, he said that the load-capacity problems which recently led B.O.A.C. to suspend temporarily the passenger service between London and Lisbon would be one of the main points of the discussion.

* * *

Air Ceylon recently increased the frequency of its Sydney-Colombo service from one to two per month.

* * *

The small South American republic of Colombia, with a population of 6,000,000, now has a total of eleven airports which are recognized as being suitable for international traffic.

* * *

A statement in these columns on April 20th concerning the services on the K.L.M. London-Amsterdam route should have made it clear that the frequency has now been increased to seven return flights daily.

* * *

In Australia, Ansett Airways have announced a 15 per cent reduction in "air-coach" fares between the larger cities; the new rates are thus much lower than fares charged by T.A.A. and A.N.A. All Ansett services make an intermediate stop between the various capital cities, whereas A.N.A. and T.A.A. fly direct.

* * *

For the first time since the war, a conference of the directors of many of Europe's larger airports was held in Paris from April 24th to 26th. Organized by Aéroport de Paris, the controlling body of the three major Parisian airports, the meeting was called to discuss the possibility of international agreement on the problems of passenger-handling at large terminals.

* * *

Air France has announced its intention of replacing by Constellations the DC-4s now used on its East African services. The change-over will be effective from May 12th, and will mean that Nairobi can be reached in 20 hr and Mauritius in 35. The service between Paris and Tananarive (Madagascar) will then stop only at Cairo and Nairobi for refuelling.

South African Airways have now finalized arrangements for the purchase of seven Lockheed Lodestars from East African Airways. The price for the seven is reported to be £40,000 inclusive of spares; E.A.A.C.'s fleet will thus be enlarged to a total of 22 aircraft.

* * *

Capital Airlines have announced that the Goodyear cross-wind landing gear will be fitted on three Super DC-3s which will be placed in service within the next few months. The innovation should allow development of internal services which, because they utilize single-runway airfields, are normally restricted to much lighter aircraft.

* * *

Answering questions put to the Canadian Parliamentary Railway Committee about T.C.A.'s operating deficit on the Atlantic route, the Minister of Trade and Commerce, the Rt. Hon. C. D. Howe, said that no profit could be predicted on this service for the next five years. After that time, he said, it would be fair for Parliament to decide whether the service should continue.

* * *

As the Ministry of Supply is taking over Aldermaston airfield, Eagle Aviation, Ltd., is now in the process of transferring its organization to Luton. C. of A. overhauls of the company's three Yorks have now been completed in preparation for summer traffic, and one aircraft left for Johannesburg last month, carrying a complete cinema and television unit and technicians for a three-week exhibition; this, it is said, is the first time any form of television will have been seen in South Africa. Eagle Aviation is concentrating on large aircraft fitted for "coach class" passengers, but readily convertible for use as freighters.

* * *

The transatlantic terminal at Gander, Newfoundland, is at present (as from April 21st) closed for about a month to all aircraft with a gross weight of over 105,000 lb. It is understood that the action of continuous thaws during the winter has had the effect of softening the surface and weakening the foundations of the runways. The closing of Gander will mean

CIVIL AVIATION NEWS . . .

that stratocruisers must use alternative airports and in some cases operations with aircraft of this type will be seriously affected. P.A.A. is diverting its aircraft to Goose Bay in Labrador, which is considerably off the course for New York and will entail a reduction of nine passengers per payload.

* * *

Barrier Reef Airways (in which Ansett Transport Industries has a controlling interest), have purchased two Short Sandringhams from T.A.A. They will replace the Catalinas at present in use, thus doubling passenger capacity on the company's services.

* * *

To meet the heavy increase in traffic expected in 1951 plans are now being made for the extension of the existing passenger buildings at London Airport. Although full details are not yet available, it is known that the intention is to provide an additional channel in both the arrival and departure buildings, so that a greater number of services can be handled at the same time. Some re-allocation of accommodation used by the operating companies will also be made, starting next month.

* * *

Lockheed have announced a new version of the Constellation; it will be designated the L-1049 and a gross weight of 116,000 lb is envisaged. The aircraft will be powered by Wright R-3350-C-18CA1 engines. The fitting of jet-type exhaust systems is expected to add up to 13 miles per hour to the cruising speed.

* * *

A £5,000 scheme to provide facilities for animals landed at London Airport is being planned by the R.S.P.C.A. The Air Ministry is understood to be willing to provide the necessary space, approximately two acres, on which suitable premises can be erected. At the moment animals are often left in aircraft all night because they are in quarantine. The question of animals being carried at various altitudes is also occupying the attention of the Society. One little known fact is that an average of 300 monkeys arrive weekly by air.

BY SAILPLANE to the CONTINENT

Crossing the Channel in an Elderly Gull of Modest Performance

By F/L. L. A. MILLER

THE location of the Reserve Command Gliding Instructors' School at Detling, some 30 miles west of the Straits of Dover, makes long-distance flights to the Continent a frequent possibility in unstable westerly to north-westerly winds. Tentative arrangements were therefore made some weeks ago for aero-tow retrieving facilities from the Continent to be available should a successful Channel crossing be made.

On Wednesday, April 12th, the personnel of R.A.F. Station Detling were on delayed "Easter" leave, and at 10 a.m. on that day I saw that conditions seemed favourable for a high, long-distance flight towards the east. Arriving at Detling at 11 a.m., I prepared for a winch launch in an old Gull I—a sailplane of pre-war vintage by Slingby's, and of similar design to the one flown across the Channel in 1939 by Mr. Stephenson. As most of R.A.F. Detling was on leave, it was not until 12.15 that I was able to get away, being winched off to 1,000 feet by the Kent A.T.C. Wing Adjutant, F/L. Emberley.

After releasing, I circled to cloud-base at 4,000 feet and then found that the wind was carrying me too far northwards of my desired track to Folkestone. From a position three miles north of Canterbury, therefore, I started to work my way south. This proved a difficult operation in the Gull I, which has limited powers of penetration (it was designed in 1937, I believe), and at one time I thought I would be forced to land.

However, soon after 1.15 p.m., I found a narrow but strong thermal which took me to cloud-base at 5,000 feet, by which time I was seven or eight miles south-west of Folkestone. I eventually reached the coast at North Folkestone at 2 p.m. and flew two or three miles out over the Straits of Dover.

I was experiencing very slight icing just beneath the cloud, and recalled that the meteorological forecast had given severe icing in cloud above a freezing level of 3,000 feet. However, conditions were such that I could utilize the cloud lift to gain height, and this I decided to do. Entering cloud, I climbed in smooth lift of about 6 ft/sec to 9,000ft, at which height the turbulence became quite severe. As the machine was then heavily iced, with clear ice an inch or more thick on the leading edges and struts, I straightened up on a course of 120 deg magnetic. The cockpit cover was, of course, also coated with ice, and the air-speed indicator had stopped working. Instruments remaining in use were the electric turn-and-slip indicator, altimeter, inclinometer, variometer and compass.

Under these conditions I descended to 7,000ft, and saw that I had left a line of cumulus clouds which extended up the Straits of Dover. I checked the surface wind from the white-caps and found that in order to reach the French coast—which I could see beneath a clear blue sky some eight miles to the south—it was necessary to make good a track almost at right-angles to the wind. My position at that time was approximately north-west of Calais, from where the coast recedes eastwards.

The coast looked very far distant in view of the ice which the machine was carrying, the strong cross-wind, and the probable performance of the Gull I under such conditions. Still without A.S.I., I flew to get a rate of sink of two metres "down" on the variometer (about 4 ft/sec). Keeping Calais in view, I finally crossed the coast west of Calais at an indicated height of 900ft above sea level. After flying over the wide stretch of sands I found a thermal and climbed to cloud-base at 3,800ft, whence I made off down a wind which was blowing straight up the coast towards Belgium. The actual Channel crossing had taken slightly over one hour.

The late start which I had made from Detling now prevented further flight for, at 900ft with nothing but "dead" sky ahead. I was forced to look for a landing place. I saw an airfield below (Coxyde) and landed at 3.50 p.m. at a dispersal point near to the runway in use.

I found that Coxyde was a Belgian Air Force base, commanded by Colonel Arends, and I became the guest of No. 1 Fighter Squadron (Commandant Roger de Weser) during my enforced stay there. I was later retrieved by an Auster from England.

In the past I have been employed for some years as a long-range heavy transport pilot on trans-ocean flights. The weather experience which I gained during that time in the Bay of Bengal during the monsoons, coupled with two years' transatlantic flying, has helped considerably in my gliding activities. To others who will undoubtedly wish to attempt long-distance flights to Europe, I would stress that instrument-flying experience is essential. Given a sound knowledge of meteorology, good instrument flying and good planning, even low-performance sailplanes are possible record-breakers in the higher wind speeds and unstable conditions of winter weather.

FROM OVERSEAS TO I.O.W.

STUDENTS from Egypt, India and the West Indies, in addition to many English club members, are now undergoing flying instruction at Cowes Aero Club, and are benefiting by the recent M.C.A. approval which reduces the hours required for a licence. Special rates are announced for members undertaking a minimum of 25 hours' flying: £2 per hour dual and £1 10s solo is now being charged. Aircraft are available for daily hire at £7 7s and £5 5s. The air display which is to be held on August 6th is now being planned, and the programme will include a number of original items, full details of which will be published in due course.

A "SPIRITED" RALLY

SPONSORED by the Bureau National du Cognac and the Aero Club de France, "Les Ailes Cognacaises" (the Cognac Flying Club) is organizing its first international air rally for July 14th, 15th and 16th, at the Cognac-Chateaubernard airport.

The number of competitors will be limited to the first 75 entries, and entry fees are from 5,000 to 12,000 francs per aircraft, according to power. Crews will be the guests of the Bureau National du Cognac. Twenty-one prizes in cash, totalling more than 500,000 francs, and 78 prizes in kind, are being awarded. According to the organizers, this means that no crew will depart with an empty cockpit and that old bottles of the famous cognac will console those who do not receive a cash prize.

Further details are obtainable from the club secretary at Cognac (Charente), or through the R.Ae.C.

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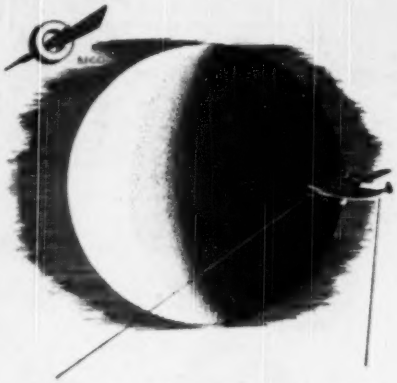

3000 MILES OF LIGHT

THE airliner winging through the dark night across three thousand miles of ocean or across continents, must be a brightly lit microcosm, separated from all human contact except for the tenuous links of radio.

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HIGH-SPEED RESEARCH

R.Ae.S. Paper on Developments in the Work of the Aerodynamics Division of the N.P.L.

A PAPER entitled *Recent Developments in High-Speed Research*, by J. A. Beavan, M.A., A.F.R.Ae.S., and D. W. Holder, B.Sc., A.C.G.I., D.I.C., A.F.R.Ae.S., was presented last Thursday, April 27th, before the Royal Aeronautical Society, at the Chemistry Lecture Theatre of Manchester University. Of considerable interest to aerodynamicists, the lecture dealt with the various wind tunnels in the N.P.L. Aerodynamics Division, and the measuring instruments and experimental techniques employed. In a section reviewing recent experiments, the authors summarized the test methods and the results obtained, but by the very nature of the work, focused as it is on fundamentals, much of this information was of interest chiefly to the aerodynamic specialist rather than to the man primarily concerned with the very much broader field of design application.

When the Aerodynamics Division took it up in 1935, research on high-speed flow was, as far as aeronautics was concerned, mainly of academic importance and could therefore be regarded as more suited to the N.P.L. than to the other establishments. The 12in tunnel, which was then built, was not only the largest high-speed tunnel in the country but was, in addition, the only one devoted to aeronautical work. During the past 15 years, the scene has changed completely, and although new equipment has been built at the N.P.L., the apparatus and staff available (the staff of the high-speed laboratory consists of four scientific and four experimental officers and has been at this level for the past seven years) are only a fraction of the nation's total facilities for research on high-speed flow.

It was the authors' contention that, this being so, it was desirable that the N.P.L. should devote most of its resources to investigations of a fundamental nature, leaving tests of supersonic designs and other practical applications to the larger and more suitable tunnels and other facilities available elsewhere. Such fundamental work was urgently needed because, although in recent years there had been a very large output of theoretical work, many of the simplest theories of compressible flow remained unchecked by experiment. Such checks were clearly important if further theoretical work was to proceed on a sound basis.

Much experimental work had been done at the N.P.L. on the mixed subsonic and supersonic flow past two-dimensional aerofoils, and the physical nature of many of the phenomena which occurred in this regime of flow were now, at least partially, understood. Real progress had been impeded by the absence of a reliable theory, even in the absence of the boundary layer, or of a theory relating to the interaction of shock waves with the boundary layer on an aerofoil surface. It seemed that a major part of the available effort could be devoted more profitably to the study of the flow round finite wings, particularly at supersonic free-stream velocities. This problem was of greater practical importance and, moreover, was covered by an extensive theory most of which remained, as yet, unchecked. With this in mind, an extensive series of balance and pressure plotting tests had been planned for the 18in × 14in tunnel on delta wings for which a theory was available.

The work on two-dimensional aerofoils would continue in the 20in × 8in and in other tunnels, not only for its own sake, but because the information thus gained on the interaction between shock waves and boundary layer might be of value in other problems. Detailed tests on a systematic family based on a representative modern section were in progress in the 20in × 8in tunnel which, in addition, had a full programme of other work. The higher Reynolds number that was available in the 18in × 14in tunnel would extend the range over which the problem of shock-wave/boundary-layer interaction had been investigated in the past in a most useful direction, and it was intended to examine the interaction for a flat plate as well as for the curved surface of an aerofoil. The problem was also to be investigated in a proposed small tunnel which might be driven either by the direct discharge of compressed air through the working section or by the vacuum pump, thus giving a large range of Mach and Reynolds numbers and enabling them to be adjusted independently. This tunnel and the 18in × 14in tunnel were, in addition, to be used for explorations of the boundary layer of sub- and supersonic main-stream flows.

Allied to the work on the interaction between shock waves and boundary layers was that involving removal of the boundary layer by suction. This might include work on the high-speed performance of new types of suction aerofoil that had been designed in another part of the Division to improve the low-speed stalling properties, or reduce the drag. These might have slots near the nose or even distributed suction over the whole nose section using porous surfaces.

The 9½in × 9½in tunnel was likely to be devoted for a considerable time to flutter derivative research. This field was of such importance at both sub- and supersonic speeds that one of the 36in × 14in tunnels to be built in the Aerodynamics Division was reserved for the continuation of these experiments with larger sized aerofoils, perhaps up to one foot chord. It was proposed also to take in the near future Schleiren photographs with a high-speed camera of the flow round an aerofoil performing pitching oscillations.

In addition to the pressure measurements on blunt-nosed plates and bodies already mentioned, the 9in × 3in tunnel was to be used for tests on families of biconvex and wedge aerofoils at supersonic speeds.

MAKING LOADS LIGHTER

FORK trucks, baggage trollies and many other kinds of small vehicles of kinds used in airport load-carrying will be on view at the forthcoming (June 6th-17th) Mechanical Handling Exhibition at Olympia, London. In addition, there will be examples of almost every kind of hoist, small mobile crane, conveyor and vehicle used in factory production work. With a floor space of over 200,000 sq ft, the show—which is organized by the journal *Mechanical Handling*—is more than twice as large as the first exhibition, held in 1948.

Concurrently, the Mechanical Handling Convention will be held, when there will be daily discussions and papers by, in all, fourteen experts on various aspects of the subject, the emphasis in each case being on practical applications. A number of films will also be shown.

Representatives of a "mechanical aids" team of the Anglo-American Council on Productivity will also attend, and will organize a discussion on the report which they made after a recent visit to America.

R.P.A.F. AT I.A.L.

REPRESENTATIVES of the Royal Pakistan Air Force recently visited the engineering department of International Aeradio, Ltd., at Bovingdon Airport. They were the Air Commander in Chief, A.V-M. R. L. R. Atcherley, C.B.E., A.F.C.; the Director of Maintenance and Supply, A. Cdre. R. G. Bowditch; and W/C. M. M. A. Cheema.

The visitors inspected work being carried out by I.A.L. in connection with a radio and radar training scheme to be instituted by the Pakistan Government. They saw a synthetic trainer, a high-power ground radar unit and V.H.F. transmitters and receivers for ground-to-air communication. They were also shown equipment for a radio teleprinter link in Pakistan which includes a "packaged" frequency-shift receiver terminal—the first of its type to be made available in this country.

Among those who escorted the party round the department were A. Cdre. E. S. Cadell, managing director, and Mr. G. Scott-Farnie, operations manager.

AIRLINE PIONEERING in AFRICA

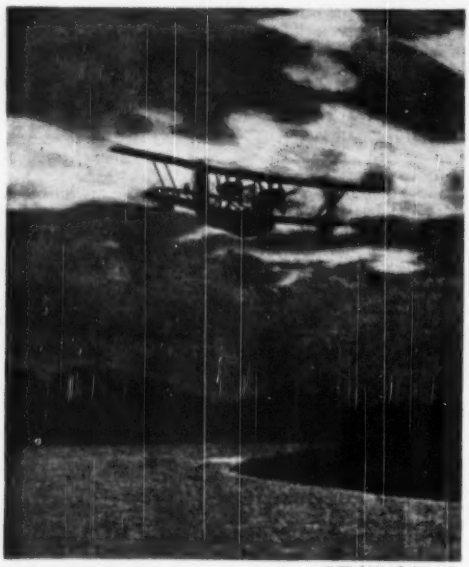
How a Route Along the Nile Was Prospected 24 Years Ago

THE recent visit of H.R.H. the Duke of Gloucester to East Africa to present the King's Charter granting Nairobi the status of a city recalls a series of pioneer civil flights made in 1926-27 to develop communications between the Middle East and this part of Africa. The operators primarily concerned were the old-established North Sea Aerial and General Transport Company (a subsidiary of Blackburn and General Aircraft, Ltd.), who today run charter services at Brough. In this article a member of their staff recalls the pioneer African flights which, in spite of a series of misfortunes, provided a sound basis for subsequent services.

Slipway: Capt. H. S. Broad taxying the D.H. 50 down the mud into the Medway after the aircraft had been named *Pelican* by Lady Ormsby-Gore.
"Flight" photograph.

THE air transport firm of North Sea Aerial and General Transport was formed in 1919 by Mr. Robert Blackburn and his brother, Captain Norman W. G. Blackburn, as a subsidiary of—as it was then known—the Blackburn Aeroplane and Motor Company; the initial object was to run a flying-boat service between Hull, Hamburg and other ports on the North Sea coasts.

Associated with the venture was Capt. T. A. Gladstone, who had a distinguished war record and was a flying-boat pilot of outstanding ability. In 1924, while on a tour of Central Africa, he was impressed with the possibilities of an air transport service along the Nile between Khartoum and Kisumu, which is in the north-east corner of Victoria Nyanza. On his own initiative he opened negotiations with the Governments concerned and, as a result, the authorities of Kenya, Uganda and the Anglo-Egyptian Sudan agreed in principle to give assistance in a preliminary survey of the air route which was to be the first step in a branch joining the Imperial route to Cairo. The Kenya Legislature agreed to contribute £2,000 towards the cost of a preliminary survey, which it was estimated would cost £9,000, and one-third was to be provided by Blackburns. The scheme was to use seaplanes operating from the Blue Nile and Lake Victoria. Initially it was intended to run a service weekly in each direction with eight passengers and 50 lb of luggage per person, together with 500 lb of mails and freight, and later the route was to be extended to Cairo in order to connect with the Imperial Airways' London-to-India service.



"Flight" photograph.

The survey of the Nile route through Africa was continued by Sir Alan Cobham's famous Short Singapore, seen here.

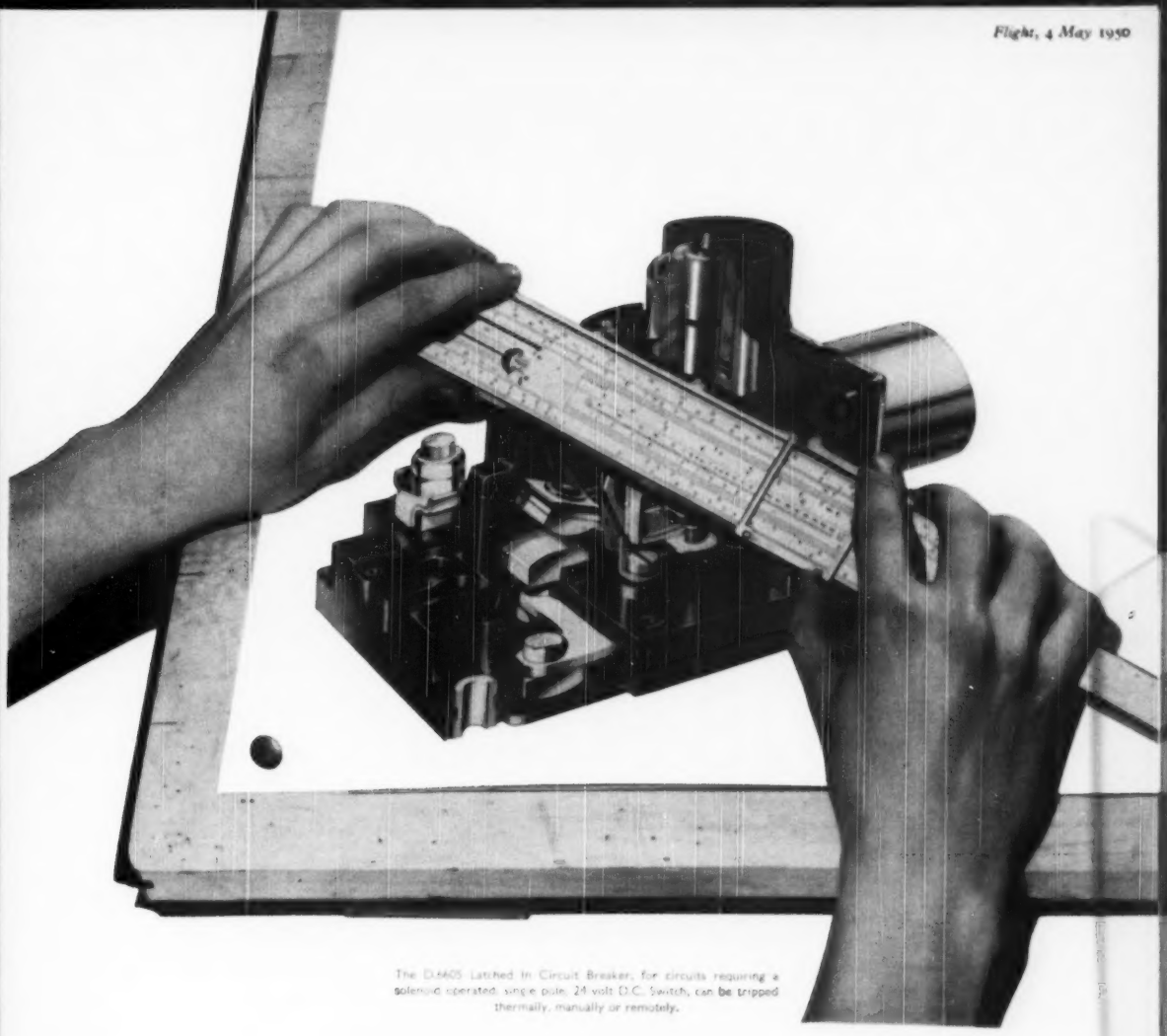
Quadripartite Effort

The venture promised to be very representative of the British aircraft industry, for the machine to be used was a de Havilland D.H. 50 powered by a 420 h.p. Bristol Jupiter Mark VI engine; the airscrew was made by Fairey's; and the whole was mounted on twin floats constructed by Short Brothers. The aircraft was named *Pelican* at a ceremony at Rochester on November 15th, 1926.

On December 30th, 1926, the first of several misfortunes intervened. The *Pelican* was taxying on the Blue Nile when the bow of the port float was ripped open by a submerged log. To replace the damaged D.H.50 the Air Ministry loaned a Fairey III D seaplane powered by a 450 h.p. Napier Lion, and on February 7th Capt. Gladstone arrived at Khartoum, to leave on the following day for the inaugural flight to Kisumu over the route which had previously been meticulously surveyed on the ground. He arrived on the 13th and returned the next day, with 120 lb of mail, *via* Jinja, Butiaba, Mongalla and Malakal. From Khartoum the Royal Air Force flew the mail on to Cairo, where it arrived on February 20th, thus saving 15 days over ground transport.

The 1,400 miles from Kisumu to Khartoum had been covered in 23 flying hours, and it was anticipated that the trip would normally be flown in three days of seven airborne hours each.

Another round flight was made, and although this East



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AIRLINE PIONEERING IN AFRICA . . .

African venture was dogged by bad luck it was instrumental in saving a life when medical assistance was flown to an officer of the Colonial Service who was ill with blackwater fever at Nimula in the Sudan.

On March 5th, Capt. Gladstone set off once again with the late A.V-M. Sir Sefton Brancker, the Director of Civil Aviation, as passenger, together with a load of mails. At Kisumu, Gladstone handed the machine over to another pilot so that he might remain in Central Africa and continue his negotiations with the various Governments. The return flight was scheduled for March 13th, but when the Fairey III D, laden with mails, was lifting from the waters of Lake Victoria, it bounced four times, the undercarriage collapsed and the machine sank. Boyle, the pilot, and Blacklock, his mechanic, were taken off by motor launch and the machine recovered, but it broke its back when landed and was irreparably damaged. The mails, however, were saved.

The Pelican, which had been repaired at the Blackburn-operated Greek Naval Aircraft Factory at Athens, resumed service on October 9th, carrying Viscount Gage, Parliamentary Secretary to the Secretary of State for India, and M. Allard, aeronautical advisor to the Belgian Government. Then, once more, fate took a hand when the aircraft was completely wrecked in a crash during a test flight eight days later.

Despite these set-backs the directors of North Sea Aerial and General Transport were confirmed in their faith in the project for a Central African Airline and they decided that the flying-boat was a better proposition than the floatplane.

About this time Sir Alan Cobham's firm became interested in the idea of an airline from Cairo to the Cape, and after sundry negotiations they joined forces with the Blackburn group, with the result that Cobham-Blackburn Air Lines, Ltd., were registered, and in 1927 Sir Alan made his famous flight round Africa in the Short Singapore flying-boat with two Rolls-Royce Condors. In the course of this journey he made several trips up and down Victoria Nyanza to check over the information which Tony Gladstone had accumulated and his reports proved conclusively that the service was a practical proposition.

Towards the end of 1928 Cobham-Blackburn Air Lines, Ltd., entered into an agreement with Imperial Airways, Ltd., with the result that the resources of the two enterprises were amalgamated and a company was formed known as Imperial Airways (South Africa), Ltd., mainly to protect Imperial Airways' interests in South Africa.

Unhappily, on May 5th, 1931, Capt. Gladstone, in company with Lt. Cdr. Glen Kidston, R.N. (ret.) was killed near Van Reenan in the Drakensberg Mountains in Natal when the starboard wing broke off their Puss Moth aircraft.

NEW AIRCRAFT WATER HEATER

AS airliner size and luxury of equipment grows, increasing demands are made on hot-water supply systems, for there may be two or more galleys and several toilets.

To meet such conditions the General Electric Co., Ltd., has introduced a lightweight all-aluminium water heater which, though of 3-gal capacity, weighs only 10 lb 10 oz when empty. The heater operates on a 120-volt supply, and the two 750 W cartridge-type immersion heaters are thermostatically controlled; they will, it is stated, maintain the temperature of the water at 170 deg F during withdrawals of up to 2½ gal. Water is supplied to the taps on the displacement system, being under pressure from the incoming feed to the heater from the main storage tank in the aircraft.

INSPECTION PROCEDURES

THE Air Registration Board announces that it now has available for issue the following new leaflets for incorporation in *Civil Aircraft Inspection Procedures*: AL/3-3, *Cable Splicing*; AL/7-4, *Transparent Plastics*; AL/8-3, *Pressure-operated Wheel Brakes*; EL/5-1, *Sparking Plugs*; EL/8-1, *Engine Instruments*; ML/3-1, *Flexible Pipes*.

It is stated that the information given in leaflet ML/3-1, being a later issue, supersedes that given on flexible pipes in leaflet AL/4-1. The total number of leaflets issued to date is 25.

FAST AND FAR-RANGING

The student of flying-boat design may profitably compare this air view of the 350-m.p.h. long-range Convair XPSY-1 (four Allison T-40 turboprops) with the pure-jet Saro Duchess illustrated on page 561. The XPSY-1 is for anti-submarine and A.S.R. work.

HELICOPTER FILMS

AT the British Council Theatre in London on April 27th, Westland Aircraft, Ltd., held a film show and cocktail party which were not only extremely well attended but, clearly, were thoroughly enjoyed by everyone present.

The two films were both in colour; the first, dealing with the capabilities of the Westland Sikorsky S.51, had its commentary spoken by Charles Gardner, and, apart from a certain *inexpertise* in cutting, a very good film it was. The second film dealt with the use of the Sikorsky S.51 by the U.S. Post Office for air-mail communication in the district of Los Angeles. In each case the showings suffered from a lack of lumens—some colour films require a stronger light-source than do monochromes—and the American film was handicapped by an almost inaudible commentary. Despite these difficulties, however, both films held the interest well.

FOR WORKSHOP USE

THOUGH equipment of the variety in question is, perhaps, a little outside the province of this journal, we cannot refrain from congratulating Wolf Electric Tools, Ltd. (Hanger Lane, London, W.5) on their enterprise in introducing the "Wolf Cub" home-constructor electric tool kits.

Intended for model-makers and for home-workshop use generally, these kits are based on the well-designed "Wolf Cub" portable electric drill (capacity, drills up to ¼in in mild steel), and consist of a series of mountings and attachments which permit the basic unit to be used as a pillar drill, wood-turning lathe, circular-saw, and for grinding, polishing and similar duties. The portable drill is priced at £4 19s 6d, and the various attachments, at comparably modest cost, can be added from time to time, on the Meccano-set principle, until the complete equipment is acquired.

ROTOL APPRENTICES REWARDED

SPEAKING at the annual prize distribution to apprentices of Rotol, Ltd., Mr. H. T. Chapman, A.F.R.Ae.S. (director and general manager, Armstrong Siddeley Motors, Ltd.) said that he did not think the gas turbine had made airscrews obsolete. "It is our company's belief," he said, "that propellers are going to be required—and when I say propellers I mean all the things that go with them—for as long as we can foresee."

Mr. Chapman recalled that since the apprenticeship scheme was started in 1939, 43 Higher National Certificates in Mechanical Engineering, and 80 Ordinary National Certificates in Mechanical and Electrical Engineering, had been gained by Rotol apprentices.

Mr. J. M. Reid, general manager of Rotol, Ltd., said that since the commencement of the scheme 144 apprentices had completed their training, and of that number 100 were still in the Company's employ.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Light Twins

I WAS interested in your leader of March 9th: "Wanted—a Light Twin." I have felt for some time that there is scope for a light twin with this specification:—

(1) Airframe all-metal (fabric-covered frame will do).
(2) Metal airscrews.
(3) *Economical* cruising speed, 150 m.p.h.
(4) Minimum range, 800 miles (distances out here are great).
(5) Seating capacity four, with, if possible, space for a limited amount of luggage.
(6) Price, £1,500.

Refinements might include a retractable hydraulic undercarriage (no electrics on any account, as the monsoon plays Old Harry with these) and V.P. constant-speed airscrews.

I expect it is pretty well impossible to produce an aircraft for this price with such a specification, but even if the price is allowed to reach £2,500, a metal twin should be a success. Speed and range and plenty of power are, to my mind, the main essentials.

M. R. C. THOMAS
Calcutta, India. (Sometime F/L., R.A.F.V.R.).

B.E.A. Names

I CAN think of nothing less appropriate than to call a fleet of elderly American Dakotas operated by B.E.A. after British aviation pioneers (see page 532, *Flight*, April 27th). I seem to remember that a fair time ago you published an article in which aviation pioneers' names were suggested for a fleet of new aircraft. This is a commendable idea, but has certain drawbacks. While passengers—that is, the public—find a certain amount of glamour in such names as *North Star* and *China Clipper*, and there is dignity in the *Queens* and *Mauretanias* of the shipping lines, with all due respect one would hardly feel like saying "I am flying east by *Alcock* to-night," or "I am browned-off with the *Brown*, it's always turning back with engine trouble." Even so, great names are well worth commemorating, and suitable among them are kings, pioneers, and knights of old.

Other suggestions, by no means all original, but nevertheless worth considering, especially for the smaller and faster types of aircraft, are the mythical gods and goddesses, fleet-of-foot animals in the antelope and hound classes, sea birds and birds of prey, winds, and weapons of the javelin and arrow kind; any of these could be prefixed with a class name, as were the "Star" types for B.S.A.A.: Golden-, Crystal-, Fleet- come to mind in this connection.

For portly transports such as the Stratocruiser type, something rather more substantial seems to be required, and here counties and historical cities are good names which have the advantage of getting the aircraft unofficially adopted by the people living in the areas concerned.

I always think the Americans and Canadians have wonderful opportunities available with the colourful names of Indian tribes and the names the Indians themselves have given to places, rivers and mountains.

A. JACKSON.
Coventry.

Universal Tenders?

ONE is interested to see (*Flight*, April 27th) that a British firm has produced mobile air-conditioning equipment for use by aircraft on the ground, for although the requirement has been obvious for some time, especially in tropical and arctic countries, it was difficult to see how an airliner could be kept properly heated or cooled when its main engines were stopped. I am glad, too, by the way, to note that the equipment referred to rates a special eight-cylinder Rolls-Royce engine.

The question now is, what is the next stage? Jet airliners will need several sorts of service at airports, and will probably have to be towed to their take-off point to save fuel and reduce noise and blast near buildings and parked aircraft. It seems that a universal tender is called for with a standard form of coupling and, perhaps, carrying a driver and engineer. The driver would, no doubt, be placed in a sort of cupola on top with a clear view in all directions, so that he could tow a large aircraft safely in restricted areas, and the engineer would serve as a look-out when not operating the tender's controls and ministering to the requirements of the airliner. The tender, with quick-release couplings to the aircraft, would provide conditioned cabin air, high-pressure air for brakes, etc., and electrical power for lighting and starting to save the aircraft batteries. This would be in addition to its towing capacity, and some of the "feeding" would be done while actually towing.

For night work it would carry headlights, adjustable spotlights to pick out the aircraft wing-tips, and plenty of coloured recognition and obstruction lights. It would have telephone connection with the aircraft, and radio-telephone communication with the control tower, possibly on a special frequency.

With practice, a great deal of taxying and parking time and trouble could be saved, apart from the fuel and power economies for the aircraft. As runway systems become more and more complex—take Idlewild, for example—pilots have their work cut out at night or during poor visibility to find their way around before and after landing, and mistakes are a potential danger. A tender driver completely familiar with the layout would need fewer instructions and would do the job more quickly. All the usual after-landing drills and checks could be carried out while being towed, the aircraft crew giving their full attention to the job rather than trying to help the captain find the tarmac. A minute or two might also be saved for the passengers if the usual pre-embarkation instructions could be broadcast to them via the tender by R/T during the towing-in process.

J. G. BLACK.
London, W.1.

Breezy Broadcast

THE paragraph in "Gliding News" in *Flight* of April 20th, concerning the broadcast from Dunstable on Easter Monday, calls for comment. The London Club's two-seater is not a T.21B but the T.21 prototype, so there was no question of replacing its windshields—it never had any, except for an experimental pair which lasted about a day and, apparently, made the airflow round the cockpit worse rather than better. The whole nose of the T.21 is shallower than that of the T.21B, so that very large screens would be needed to protect the crew, and no satisfactory design has so far been evolved.

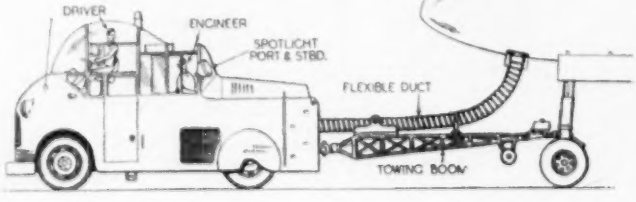
The lack of windscreens is no great disadvantage in normal conditions and at normal speeds, but on Easter Monday the air was very rough, especially at the time of the broadcast, when a front was still passing through, and it was necessary to fly fast—in the case of the two-seater, at about one and a half times normal speed—to avoid being blown behind the ridge and being stalled by a down-current.

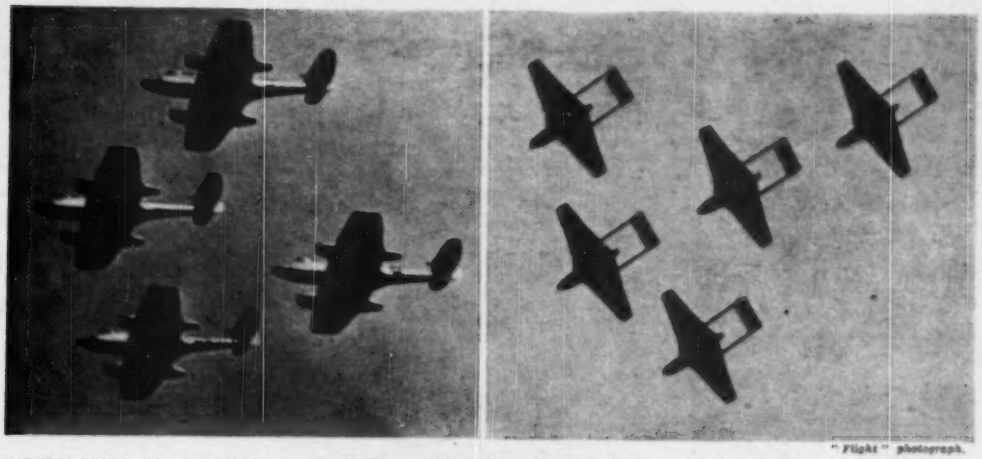
I was flying the Prefect at the same time, and found conditions quite terrifying, with severe gusts, lift and sink inextricably mixed, and the high wind speed making wariness of being blown back very necessary. My barograph recorded one "down" of 400ft in 14 sec!

Incidentally, I believe we were the only major club operating on that day, and in those conditions a broadcast from any glider, even with screens or a full canopy, would have given the lay public the impression that gliding is a pretty hectic affair.

PETER RIVERS.
London, N.W.3.

An artist's conception of the appearance of the airport "universal tender" suggested by J. G. Black.





"Flight" photograph.

NEAT WORK by Meteors and Vampires at the Thorney Island demonstration referred to in the caption at the foot of the page

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

Pageantry in the Air

THE R.A.F. will play a distinctive part in future celebrations or occasions of national importance, His Majesty the King having given approval for formation flights, usually over London, to take place at such times. Flights will be made by not less than three squadrons of aircraft. Fighter, Bomber, Coastal and Transport Commands will provide the aircraft in rotation.

Occasions so commemorated will include the Sovereign's official birthday and such events as the birth of a Royal Prince or Princess and the wedding of a child of the Sovereign.

In overseas commands, where the occasions will be similarly marked, the formations will normally fly over the Government House, or, where there is no direct representative of the Sovereign, in the vicinity of the Headquarters of the R.A.F. formation concerned.

In announcing this new policy, the Air Ministry makes use of the term "flypasts." It might be an appropriate time for the R.A.F. to select a more pleasing phrase, such as "air parade," in keeping with the formal nature of the occasions to be celebrated.

G/C. Ramsbottom-Isherwood

WITH regret *Flight* records the death, on April 24th, in a flying accident, of G/C. H. N. G. Ramsbottom-Isherwood. He had commanded R.A.F. Station West Malling, since July 9th, 1949, having previously been a Deputy Director of Command and Staff Training at the Air Ministry since August, 1947.

G/C. Ramsbottom-Isherwood had a distinguished war record. In January, 1941, he was given command of a sector of No. 9 Group, and later served as controller at the Group Headquarters before being appointed to lead No. 151 Wing of Hurricanes, which was sent to Russia later in the year.

Salute to "Ark Royal"

DURING the launching of the carrier *Ark Royal* by her Majesty the Queen at Liverpool yesterday, the following squadrons, operating from Royal Naval Air Station Stretton, were due to fly past: Nos. 809 and 802 (six Sea Hornets and twelve Sea Furies), and Nos. 1831, 1832 and 1833 (sixteen Seafires). Nos. 809 and 802 Squadrons are regular units and the others R.N.V.R. Lt.-Cdr. J. O. Armour, who commands No. 809 Squadron, was due to lead the fly-past, and the R.N.V.R. element was to be under the command of Lt-Cdr. R. I. Gilchrist, commanding officer of No. 1831 Squadron.

Charter Trooping Service?

THE Air Ministry is reliably reported to be considering the possibility of employing commercial aircraft and crews to supplement Transport Command's trooping service from Britain to the Middle East and Far East. It is thought that if the project materializes, the crews would become members of a special R.A.F.V.R. branch. In a recent leading article, *Flight* added support to the proposal that the larger charter companies should be organized as an auxiliary transport force for use in war-time.

Realization of such a policy—which, in any case, seems a logical and inevitable result of financial restrictions on the peace-time strength of Transport Command—would be greatly facilitated by everyday Service use of civil resources. For the charter companies, too, the scheme has advantages. Like the Air Lift, it would constitute both a valuable national service and also ensure that the

"Flight" photograph.

DELEGATION: Seen with G.C. H. Eeles, C.B.E., at Thorney Island, where they inspected the station and witnessed a flying demonstration, are members of the Egyptian Parliamentary Delegation.

SERVICE AVIATION . . .

operators can use the full—and therefore most economical—potential of their fleets.

An equally promising suggestion, affecting the servicing problem, is that the R.A.F. should sub-contract a proportion of its work to certain civil maintenance concerns.

Curtis Prize Awarded

FOR the second year running the Curtis Memorial Prize, awarded to the member of the R.A.F. gaining best marks at each Force's Preliminary Examination, has been won by an ex-apprentice. The winner of this year's prize, the second to be awarded since the war, is F/S. D. P. T. Copcutt, who has now transferred to Class E reserve. At the time of the examination he was serving as a fitter armourer at Horsham St. Faith.

The Prize is a money award derived from funds subscribed by members of the former R.A.F. Educational Service as a memorial to the late Col. Ivor Curtis, C.B.E., who was Educational Adviser to the Air Ministry from 1918 to 1928.

N. Ireland Appointment

WITH effect from May 1st, A. Cdre. N. A. P. Pritchett has been appointed Air Officer Commanding No. 67 (Northern Ireland) Reserve Group and Senior Air Force Officer in N. Ireland. He previously served in his new command in 1941-42, when he formed, and became C.O. of, the Coastal Station at Nutts Corner, Belfast.

A. Cdre. Pritchett recently relinquished the post of Director of Manning at the Air Ministry, which he had held since December, 1947. Most of his war service was spent with Coastal Command. Born in 1903, he was commissioned from Cranwell in 1923 and served with the Fleet Air Arm for some years before the war, in the carriers *Argus*, *Furious* and *Glorious*.

Bomber Command Reunion

HOSTELRIES within the Central London area will be the objectives of a vast force of ex-Bomber Command members operating on Saturday, May 20th. The unique Bomber Command Reunion for 1950 has been planned by the Pathfinder Association, in co-operation with the R.A.F.A.; each war-time station has been allocated a London "local" to enable old friends to find each other without difficulty. Below is reproduced a complete list of rendezvous points for the various units. Further details will be given by the Pathfinder Association, 115, Mount Street, London, W.1, provided that each individual enquiry is accompanied by a stamped addressed envelope.

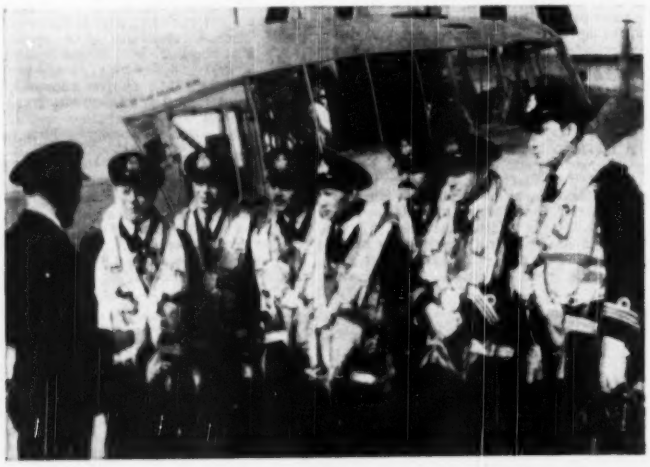
RESCUERS: Seen at the R.A.F. Transport Command booking centre in Devonshire Street, London, before leaving for Malaya to fly Westland-Sikorsky helicopters on ambulance and rescue duties, are Flight Lieutenants K. Fry (left) and G. Meyrick.

Elsham Wolds, Kirmington.—Bear and Staff, Bear Street, Charing Cross Road. *North Killingholme.*—Bunch of Grapes, 45, Strand. *Ludford Magna.*—Castle, Furnival Street, Holborn. *Wickenby, Foldingworth.*—Clachan, 34, Kingley Street, Regent Street. *Scampton.*—Horse Shoe Hotel, Tottenham Court Road. *Hemswell.*—The Crown, Gt. Monmouth Street, W.C.2. *Fiskerton.*—The Crown, 51, New Oxford Street. *Dunholme Lodge, Cammeringham.*—Devonshire Arms, 212, Devonshire Street, Portland Street, W.1. *Grimsby, Binbrook, Kelstern.*—Duke of Gloucester, 487, Oxford Street. *Stradishall, Chedburgh.*—The George, 1, D'Arblay Street, W.1. *Wratting Common, Gosfield, Birch.*—Golden Lion, 25, King Street, St. James's.

Middenhall.—The Beehive, Crawford Street, off Baker Street. *Methwold, Tuddenham.*—Helvetia, 23-25, Old Compton Street, W.1. *Waterbeach, Mepal.*—Plume of Feathers, Oxford Street. *Witchford, Fellwell.*—King John's Head, Albemarle Street. *Pocklington, Elvington.*—Blue Posts, Newman Street, W.1. *Full Sutton.*—Cock Tavern, Gt. Portland Street. *Driffield.*—Duke of Wellington, Wardour Street. *Leconfield.*—George and Dragon, 64, Shaftesbury Avenue. *Lissett.*—Horse and Groom, 128, Gt. Portland Street. *Holme.*—The Final, William IV Street, Charing Cross. *Breighton.*—Golden Lion, Dean Street, Shaftesbury Avenue. *Melbourne.*—Coach and Horses, Bruton Street, W.1. *Snaith.*—Holyrood, Wells Street, W.1. *Burn.*—Pillars of Hercules, Greek Street, Soho.

Woodbridge, Carnaby.—Bag o' Nails, Buckingham Palace Road. *Waddington.*—The Lincoln, Blandford Street, W.1. *Skellingthorpe.*—Mason's Arms, Tichborne Street, W.1. *Bardney, Coningsby.*—Red Lion, Princes Street, Westminster. *Woodhall Spa, Metheringham.*—Round House, 1, Garrick Street, W.C. *East Kirkby, Spilsby.*—Sun and Horseshoe, Mortimer Street, W.1. *Strubby, Syerston.*—Sunderland Arms, Sackville Street, W. *Fulbeck, Balderton.*—Stags Head, New Cavendish Street, W.1. *Luton-on-Ouse.*—Turner's Arms, Crawford Street, W.1. *Tholthorpe, East Moor, Leeming.*—Devonshire Arms, 17, Denman Street, Piccadilly. *Shipton-on-Swales, Dishforth, Middleton-St. George.*—Woodstock, Woodstock Street, W.1. *8 Group*—*Pathfinder Stations.*—Pathfinder Club, 115, Mount Street, W.1. *Radlett, West Raynham.*—New Inn, Edgware Road.

Foulsham, North Creake.—Red Lion, 2, Duke of York Street, Jermyn Street. *Little Snoring, Swannington.*—The Crown and Two Chairmen, 32, Dean Street, Soho. *Gt. Massingham, Oulton.*—Peele's Hotel, 177-178, Fleet Street. *Swanton Morley.*—Horse and Dolphin, 25, St. Martin's Street, Leicester Square. *Lindholme, Blyton, Sandtoft, Sturgate.*—The Phoenix Hotel, 19, Princes Street, Cavendish Square, W.1. *North Luffenham.*—Porcupine, 48, Charing Cross Road. *Woolfox Lodge, Bottesford, Langar.*—The Two Chairmen, 1, Warwick Street, Charing Cross. *Marston Moor, Rufforth, Acaster Malbis.*—Royal George, 133, Charing Cross Road. *Swinderby, Wigsley, Winthorpe.*—Bunch of Grapes, Shepherds Market, W.1. *Topcliffe.*—Yorkshire Grey, Piccadilly. *Wombleton, Dalton.*—King and Prince of Wales, 51, Brick Street, Piccadilly. *Finningley, Worksop.*—The Rising Sun, Ebury Bridge Road, S.W.1. *No. 91 Group Stations.*—Scots House, Cambridge Circus, W.C. *No. 92 Group Stations.*—Marquis of Granby, Cambridge Circus, W.C. *Brampton Grange, Kelstenngham Hall.*—York Minster, Dean Street, W.1. *Elvedon Hall, Cottesmore.*—The Falcon, Wardour Street. *Folkingham, Lakenheath.*—Grosvenor Arms, Grosvenor Street, W.1. *Marham.*—Lord Belgrave, Whitcomb Street, W.C.2. *Sculthorpe.*—Horse and Groom, 22, Whitcomb Street, W.C.2. *Squadrons based in Italy.*—Running Footman, Charles Street, Mayfair. *Squadrons based in Middle East.*—Mayfair Hotel, 7, Down Street, Piccadilly. *All other Stations and Squadrons.*—Shepherds Hotel, Shepherds Market, W.1.



FIVE NAVIES are represented in this scene at Hamble, in which officers are receiving instructions before taking off in an Anson of the Royal Naval Air Signal Squadron, stationed at Air Service Training. Left to right are Lt. H. G. Cunningham, R. N. (instructor), Lt. E. Kristiansen, Royal Norwegian Navy, Lt. Cdr. K. Notaris, Royal Hellenic Navy, Lt. K. Hashish, Royal Egyptian Navy, Lt. K. Daing, Burmese Navy, Lt. A. Fahmy, Royal Egyptian Navy, Lt. Cdr. N. Strathakis, Royal Hellenic Navy and Lt. Cdr. C. H. Papasifakis, Royal Hellenic Navy.

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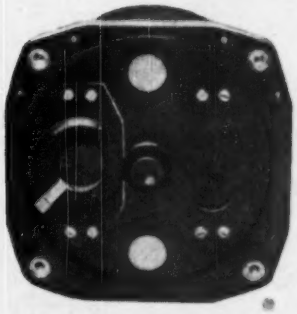

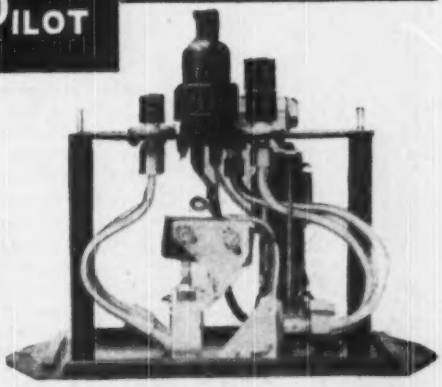

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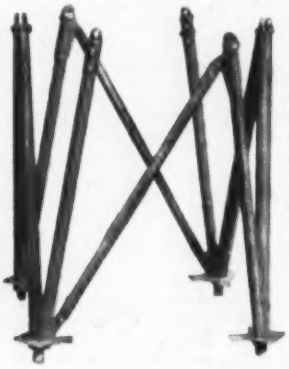

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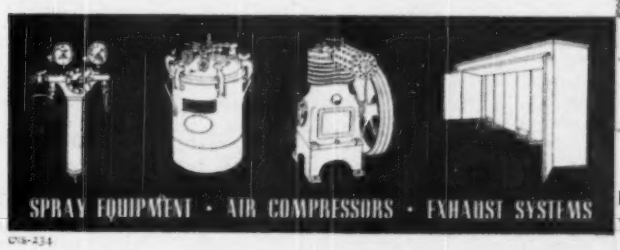

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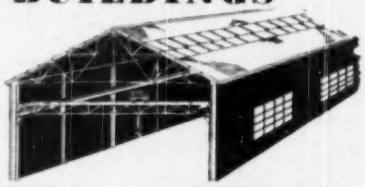

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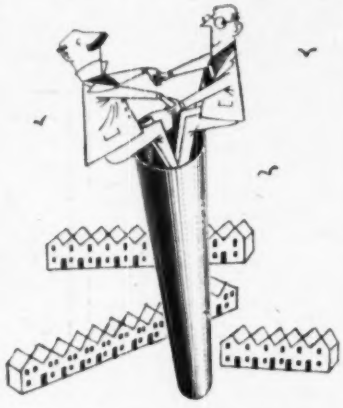

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